AUG 25 1923


# The Heating and Ventilating Magazine

*A Monthly Journal of Engineering Progress*

AUGUST, 1923

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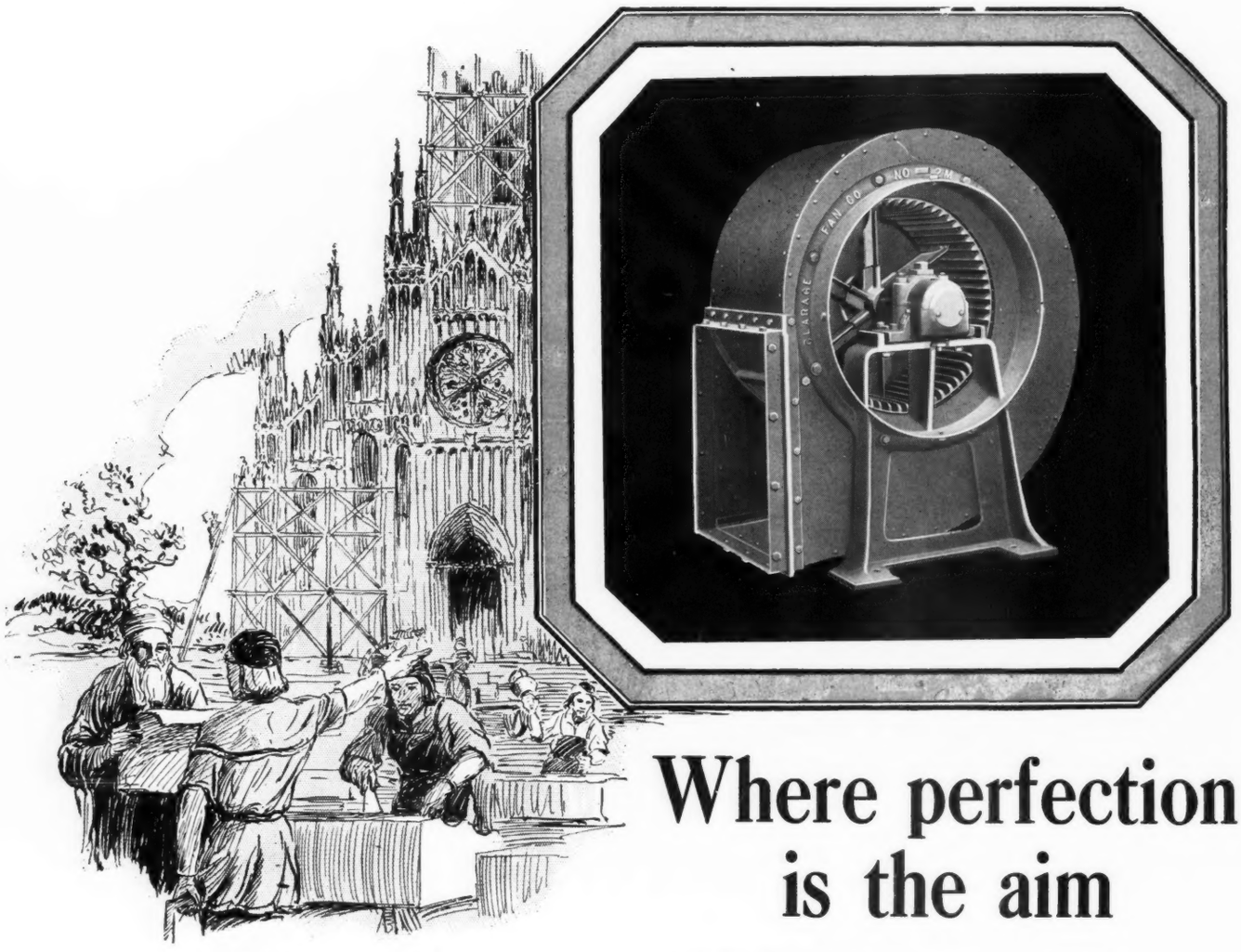


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The Heating and Ventilating Magazine

Vol. XX. No. 8

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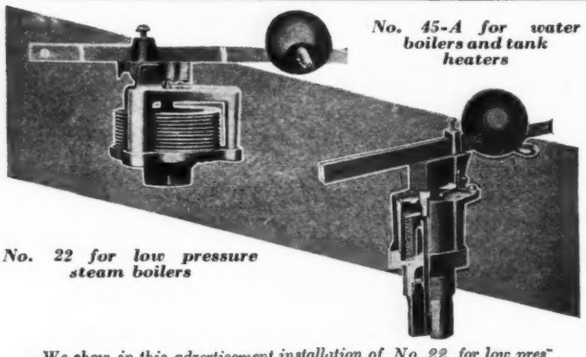

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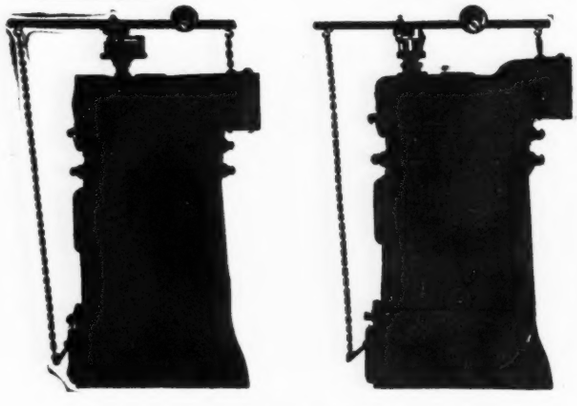

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The Heating and Ventilating Magazine

*A Monthly Journal of Engineering Progress.*

AUGUST, 1923

# Performance Data on Nineteen Radiator Traps

## Results of Recent Tests Covering Such Points as Venting of Air, Drainage of Water, Trapping of Steam and Freedom from Noise

AN IMPORTANT work has been done during the past year by the Committee on Research of the National Association of Building Owners and Managers in testing radiator traps. No less than nineteen well-known makes were selected and subjected to a comprehensive series of laboratory tests. It is proposed to follow these up with reports on experiences in building operation covering the points of freedom from fouling and maintenance.

The full test figures and data are contained in a preliminary report published by the association. In addition to the tests themselves, the report takes up in an interesting way the principles of heat, the various types of heating systems and boilers, together with a general discussion of the functions and classifications of radiator traps.

As the report states, a complete and adequate system of tests would measure each trap in respect to its performance of all of its duties, including:

(*a*) Venting of air.
(*b*) Drainage of water.
(*c*) Trapping of steam.
(*d*) Performance under service conditions.
(*e*) Freedom from noise.
(*f*) Freedom from fouling.
(*g*) Maintenance.

Unfortunately, no single system can measure performance in all of these duties. The only way, it is pointed out, to obtain complete results lies in combining a system of laboratory testing with a system of reporting building experience (the experience of managers of buildings in the actual use of the traps with which their buildings are equipped).

### ADVANTAGES AND DISADVANTAGES OF LABORATORY TESTING

The system of testing which the Committee on Research worked out for laboratory use covers the first five of the seven enumerated duties of the trap. Laboratory testing, it is added, so far as these five trap duties go, produces results of a considerable degree of accuracy and, so far as different kinds of traps go, a considerable degree of fairness.

The advantage of laboratory testing, as far as it goes, lies in the exact scientific methods used and results recorded. The disadvantage lies in the limited ground covered.

### VALUE OF BUILDING EXPERIENCE

The value of data based on extended service in buildings is emphasized in the report by the statement that it is upon building experience (the experience of managers of buildings in the actual use of the traps with which their buildings are equipped) expressed in the form of questionnaires, that we must rely for testing the two remaining duties of the trap:

(*f*) Freedom from fouling.
(*g*) Maintenance.

The advantage of building experience lies, of course, in the broad ground covered. It is proposed to make hundreds, even thousands, of observations of the traps of a single make. The performance will, in most cases, cover a period of years—instead of hours. Every variety of service conditions will be covered. On the other hand, the disadvantage of building experience, as the committee recognizes, lies in the absence of exact, scientific methods, and the entrance of the human element with its capacity for error. Obesrvations will, in most cases, be opinions, rather than test and measurement; recording, in most cases, will be in generalities rather than in figures.

### GENERAL ARRANGEMENT OF TEST

The accompanying diagram (Fig. 1) indicates merely the general construction of a trap-testing apparatus.

The steam enters the trap through the inlet valve. At the opposite end of the radiator is installed the trap to be tested. The water of condensation, drained by the trap, flows directly downward into Pot A. Any steam that may be passed by the trap rises up into the condenser, where it is cooled and condensed to water, and flows into Pot B.

CONDENSATION RATIO

Pots A and B are emptied from time to time, the water from each being carefully measured. The proportion of the contents of Pot B to the contents of both pots is obviously the percentage of steam passed and not trapped. Taken the other way around, the proportion

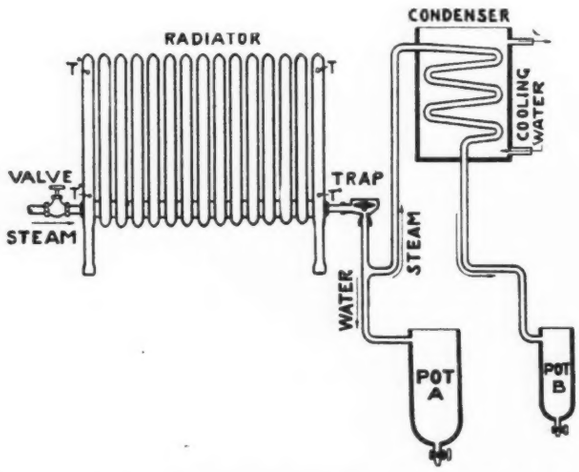


**Fig. 1—General Diagram of Testing Apparatus.**

of the contents of Pot A to the contents of both pots is obviously the percentage of steam entirely condensed in the radiator; it is the precentage of steam-trapping efficiency of the trap in operation.

TEMPERATURE RATIO

As to water-draining efficiency, this is tested by thermometers $T_0$ attached to the outside of the radiator at different points. These indicate by their temperatures whether inside the radiator at these points there is (hot) uncondensed steam, or (cooler) water of condensation. These temperatures by their proportions indicate the water draining efficiency of the trap in question.

Air-venting efficiency is considered indicated by the same thermometer and temperature proportions that indicate water-draining efficiency.

TESTING APPARATUS USED

Fig. 2 indicates the exact construction of the apparatus used in the tests made by the committee. This apparatus, it may be added, conforms in every respect with that used and recommended by the United States Bureau of Standards. The total radiator surface is 80 sq. ft.

The steam used comes by way of a supply pipe (A) equipped with a steam gauge (B), a reducing valve (C) and a second steam gauge (D). By operation of the pressure-reducing valve and by observation of the two steam gauges, the different pressures required by different tests are obtained.

The steam passes by the pipe (E) into a steam separator where any water of condensation is collected and from the top of which clean and dry steam can be taken by the pipe (F). To this pipe is attached a mercury gauge registering in inches the pressure of the steam actually used. In the tests of the committee, the first set of tests was at 6 in. pressure and 10 in. vacuum; the second at 6 in. pressure and 0 in. vacuum; and the third at 1 in. pressure and 5 in. vacuum.

The steam passes by the pipe (F) and by an inlet valve into the radiator, the pipe and the first column of the radiator being cross-connected by the glass water-gauge. Any water of condensation about the inlet valve and the adjoining column or two of the radiator is indicated in the water-gauge. The temperature of the incoming steam was calculated according to the indicated pressure at which it entered the radiator.

HOW THE TEMPERATURE RATIO IS DETERMINED

The radiator is equipped with thermometers at the points indicated which give the surface temperatures of the radiator at those points. If these temperatures be

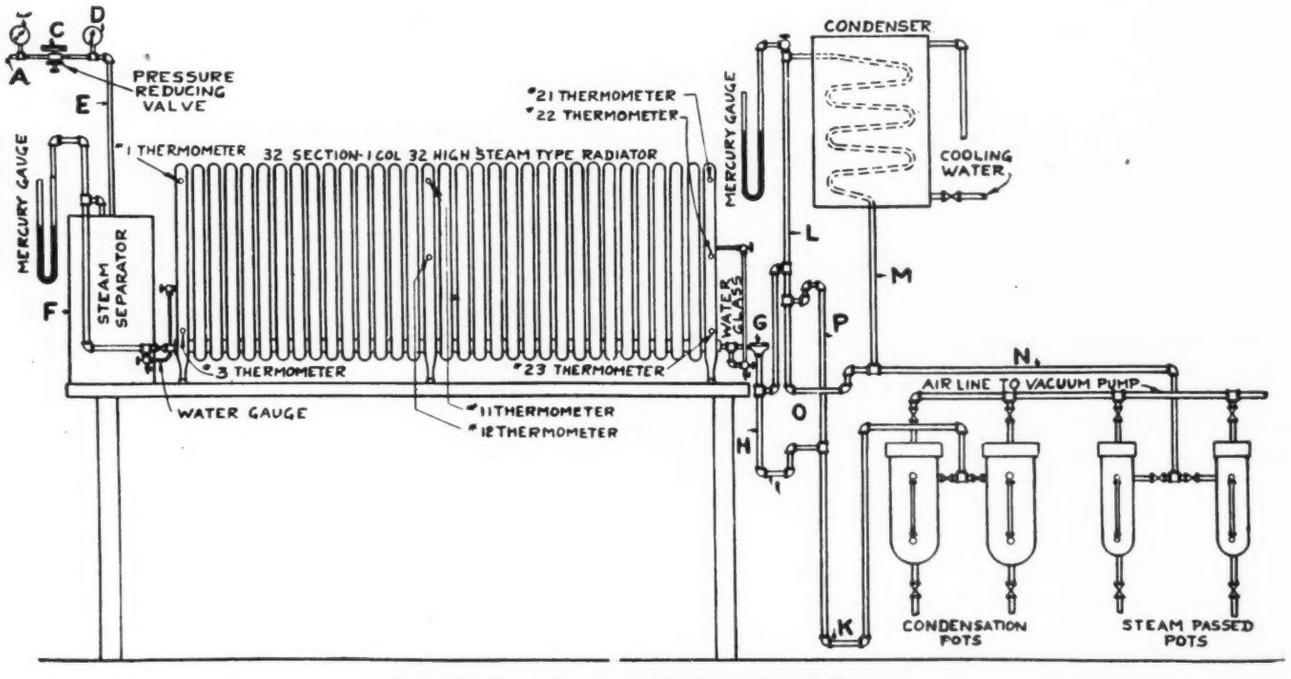


**Fig. 2—Apparatus Used in Committee's Tests.**

averaged, we have the average temperature of the entire radiator surface. The average temperature of the entire surface, divided by the temperature of the incoming steam, gives what is called a "temperature ratio." (To make this ratio more exact for the purpose for which it is to be used, the room temperature is subtracted from the temperature of the incoming steam and from the average temperature of the surface of the radiator, before the above division is effected).

It is obvious that if the air were not vented from the radiator, the radiator would not completely fill with steam and the average surface temperature would be much below that of the steam at the inlet valve. It is also obvious that if the water of condensation were not drained from the radiator, but filled the lower part of the columns, not only would the surface of the radiator be cooler where the water was so gathered, but also that such accumulation of water would obstruct the free flow of steam to the several columns (in the case of a radiator of the "column-steam" type); and the surface temperature of the radiator would be lowered thereby. Accordingly, the above temperature ratio is assumed to measure the efficiency of the radiator in the performance of two of its duties, namely, the venting of air and the drainage of water.

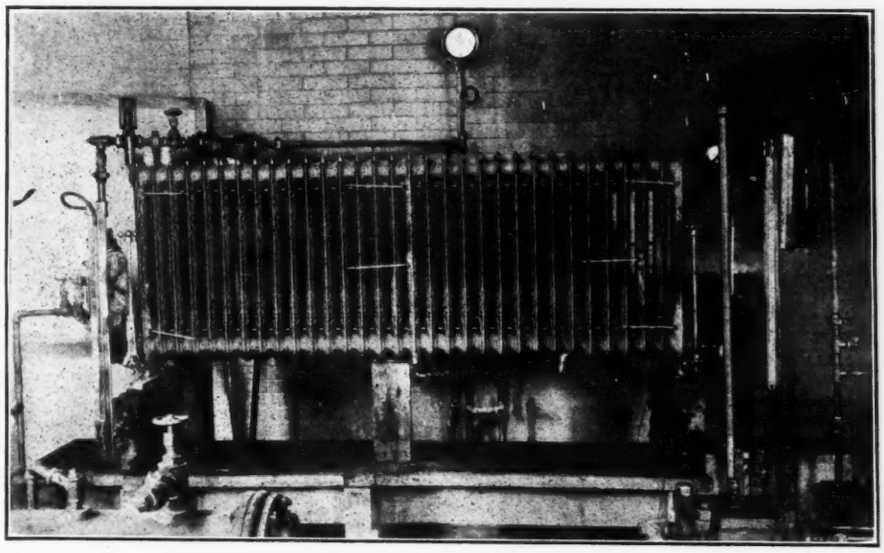

**Fig. 3—View of Apparatus During Test.**

### DRAINAGE OF WATER

As the steam condenses in the radiator, the water of condensation passes out of the radiator through the outlet. The outlet pipe and the last column of the radiator are cross-connected with a water-glass similar to that cross-connecting the inlet pipe and the first column, and adapted to show the water level at this point.

The trap that is being tested (G) is connected to the outlet pipe and functions in the usual manner. The water of condensation, draining through the trap (G), flows down through pipe (H) into the first of two water siphons (I). The overflow from the water siphon (I) flows into the water siphon (K). The overflow from the water siphon (K) flows into one of the condensation pots.

It is obvious that the pipe (H) might connect directly with the condensation pots without the two intermediate siphons (I) and (K). But in such case there would be more or less of a flow of current of water which might carry with it some part of such steam as passes the trap. Accordingly, it has been found better practice to eliminate any flow or current by introduction of the two water siphons. These are filled with water at the beginning of the test. It is merely their overflow which passes into the condensation pots and is measured.

It will be noticed that two condensation pots are used. While one pot is receiving water from the radiator, the other pot is shut off and its contents drawn and measured, and vice versa.

### PASSING OF STEAM

Whatever steam the trap allows to pass (without trapping) rises through the pipe (L) into the condenser where it is collected and condensed to water. This water flows through the pipes (M) and (N) to the two steam-passed pots. One of these pots receives the water while the other is shut off and its contents drawn and measured, in the same way as the condensation pots.

It has been found that some of the steam rising through the pipe (L) on the way to the condenser condenses before reaching the condenser. Nevertheless, it has passed the trap as steam and is therefore to be measured as steam passed. Accordingly, it must be conducted to the steam-passed pots, which is accomplished through the pipe (O) connecting with the pipe (N) above referred to.

The total amount of water collected both in the condensation pots and in the steam-passed pots (measured in pounds) is evidently equal to the amount of steam received by the radiator (also measured in pounds). The amount of water collected in the condensation pots alone, in proportion to that collected in both sets of pots, is obviously the percentage of steam which the radiator has condensed and which the trap has trapped until so condensed. It is the measure of efficiency of the trap in its duty of the trapping of steam.

### USE OF VACUUM PUMP TO REPRODUCE SERVICE CONDITIONS

In order to reproduce service conditions, it is necessary to provide a degree of vacuum on the return system. This is accomplished by connecting a vacuum pump to an air line which leads to each of the steam-passed pots and the condensation pots. But such a vacuum applied to the condensation pots would obviously disturb the water siphons (I) and (K), and pull part of the water of these siphons into the condensation pots. It is necessary to balance this pull by one in the opposite direction. This is accomplished by cross-connecting the outgoing water line with the outgoing steam line by a section of pipe (P). The steam line (L) is under the same vacuum by reason of the vacuum pump connection with the steam-passed pots.

The degree of vacuum is measured and registered by a mercury gauge at the top of steam pipe (L). In the first set of tests, a vacuum of 10 in. of mercury was used; in the second, a vacuum of 0 in.; and in the third, a vacuum of 5 in.

### POSSIBILITY OF RE-EVAPORATION

The apparatus described, the report states, functions with reasonable exactness in all respects but one. That is what is called "re-evaporation." In explaining this the report states:

In the first set of tests, the pressure of steam in the radiator is at 6 in. of mercury (more than atmosphere). At this pressure, water condenses at a temperature of 221° F. (instead of at 212° F. when under atmospheric pressure). Let us assume some water of condensation at 210° to pass the trap—as water.

This water, on flowing into the pipe (H), enters a partial vacuum represented by 10 in. of mercury (less than atmosphere). In this (partial) vacuum, water boils

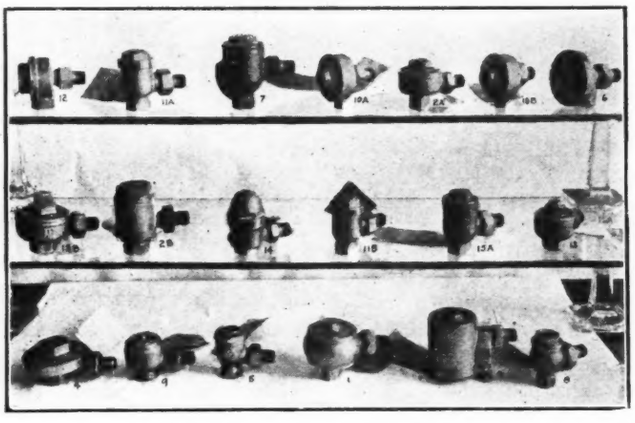

**Fig. 4—The Traps Tested.**

at 192° F. It is obvious that the 210° water of condensation entering this condition of (partial) vacuum, will boil. A certain amount of it will turn into steam, although it passes the trap as water.

This "re-evaporated" steam will ascend through the pipe (L), go into the condenser and so to the steam-passed pots. It will add to the amount of water measured there. It will diminish the proportion of water which is credited as condensed in the radiator.

There appears to be no method of avoiding this result, or of assuming with certainty and exactness how much re-evaporation takes place under any given condition. However, while some amount of re-evaporation might make an unfavorable showing for some one trap tested by itself, when a considerable number of traps which function in a similar manner are tested under identical conditions, the amount of re-evaporation may be supposed to be approximately the same in each.

To this view the report notes one line of exception. If one trap passes hotter water than another, it is more likely to give re-evaporation. And if a trap passes steam, this would mean that the water passed is hotter still, and there would be still more re-evaporation. In short, if a trap condenses thoroughly, there will be little re-evaporation; if a trap does not condense thoroughly, the steam which it passes is likely to be exaggerated by re-evaporation.

### THE TRAP MANUFACTURERS WHO CO-OPERATED

Following is a list of the manufacturers who co-operated with the committee in having their traps tested:

A & B Steam Specialties, Chicago, Ill.
Bishop & Babcock Co., Cleveland, O.
C. A. Dunham Co., Chicago, Ill.
Heating & Power Appliance Co., Milwaukee, Wis.
Hoffman Specialty Co., Waterbury, Conn.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
James P. Marsh & Co., Chicago, Ill.
Monash-Younker Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Sarco Co., Inc., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Warren Webster & Co., Camden, N. J.
William S. Haines & Co., Philadelphia, Pa.

Among the conditions laid down by the committee were that each trap to be tested should be personally selected by the engineer of the committee from stock. The testing equipment used was loaned by the Trane Co., of La Crosse, Wis. This apparatus was set up in the steam laboratory of the College of Engineering of Lewis Institute, Chicago.

The tests were conducted under the personal supervision of, and vouched for, by Professor Julius Wolf, assistant professor of steam engineering of Lewis Institute. Professor Wolf used as assistants Messrs. Louis Berman and S. Phatakwala, students of Lewis Institute. The engineer of the committee, Benjamin K. Read, took part in setting up the apparatus, discussed and advised upon all of the problems that arose, and was present from time to time throughout the tests.

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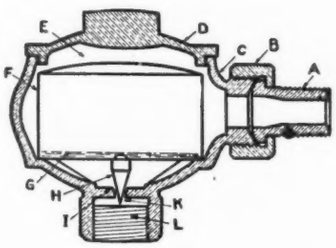
## Test Data

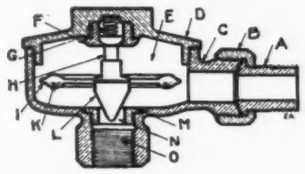
**TRAP NO. 1.**
**The A. & B. Trap, float and liquid thermostatic type.**




| | First test | Second test | Third test |
|---|---|---|---|
| Date of test | Dec. 13, '22 | Dec. 12, '22 | Dec. 13, '22 |
| Barometer reading, in. | 29.67 | 29.66 | 29.67 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 79.7 | 75.7 | 83 |
| Radiator (av.) | 220.2 | 220.1 | 212.8 |
| Steam Inlet (av.) | 221.0 | 221.0 | 213.3 |
| **Temperature Ratio, %** | **99.4** | **99.3** | **99.6** |
| Weights of Water, lbs.: | | | |
| Total condensation | 48.3 | 54.1 | 44.72 |
| Condensation per hour | 16.1 | 18.03 | 14.91 |
| Total steam passed | 3.8 | 0.2 | 3.8 |
| Steam passed per hour | 1.27 | 0.07 | 1.3 |
| **Condensation Ratio, %** | **92.8** | **99.5** | **91.9** |

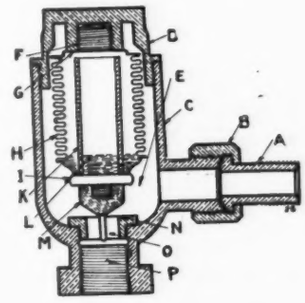
**TRAP No. 2-A.**
**Bishop & Babcock Vacu.**

**Thermostatic Type.**



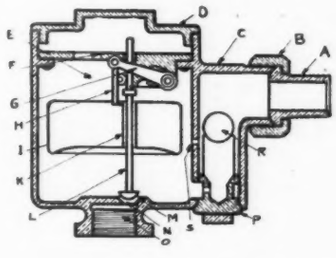
| Date of test | First test Aug. 24, '22 | Second test Aug. 24, '22 | Third test Aug. 25, '22 |
|---|---|---|---|
| Barometer reading, in. | 29.20 | 29.20 | 29.20 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 92.8 | 96.1 | 78.8 |
| Radiator (av.) | 218.1 | 218.4 | 208.7 |
| Steam inlet, (av.) | 220.3 | 220.3 | 212.5 |
| **Temperature ratio; %** | **98.2** | **98.4** | **97.3** |
| Weights of water, lbs.: | | | |
| Total condensation | 47.64 | 43.74 | 57.98 |
| Condensation per hour | 16.81 | 16.43 | 19.32 |
| Total steam passed | 0.17 | 0.1 | 0.90 |
| Steam passed per hour | 0.06 | 0.03 | 0.30 |
| **Condensation ratio:** | **99.6** | **99.8** | **98.4** |

**TRAP No. 2-B**
**Bishop & Babcock Multi-flex, Liquid Thermostatic Type.**



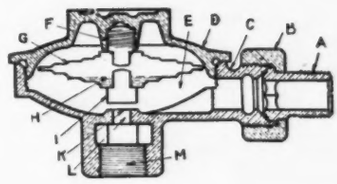
| Date of test | First test Dec. 21, '22 | Second test Dec. 15, '22 | Third test Dec. 22, '22 |
|---|---|---|---|
| Barometer reading, in. | 29.38 | 29.47 | 29.16 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 80.1 | 84.7 | 82.0 |
| Radiator (av.) | 218.4 | 219.5 | 211.2 |
| Steam inlet (av.) | 220.6 | 220.7 | 212.4 |
| **Temperature ratio:** | **98.4** | **99.0** | **99.0** |
| Weights of water, lbs.: | | | |
| Total condensation per hour | 45.87 | 50.65 | 43.53 |
| Condensation per hour | 15.29 | 16.88 | 14.51 |
| Total steam passed | 0.45 | 0 | 0 |
| Steam passed per hour | 0.15 | 0 | 0 |
| **Condensation ratio:** | **99.0** | **100** | **100** |

**TRAP No. 3.**
**Dual Valve, Jr., Float Type.**



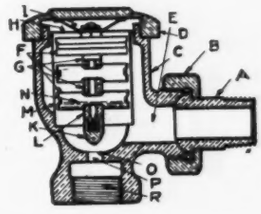
| Date of test | First test Nov. 14, '22 | Second test Nov. 15, '22 | Third test Nov. 13, '22 |
|---|---|---|---|
| Barometer reading, in. | 29.38 | 29.52 | 29.56 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 83.5 | 80.7 | 82.2 |
| Radiator (av.) | 219.9 | 220.0 | 212.3 |
| Steam inlet (av.) | 220.5 | 220.7 | 213.0 |
| **Temperature ratio:** | **99.5** | **99.5** | **99.4** |
| Weights of water, lbs.: | | | |
| Total condensation | 52.92 | 56.45 | 46.11 |
| Condensation per hour | 14.31 | 18.82 | 15.37 |
| Total steam passed | 5.95 | 3.35 | 2.25 |
| Steam passed per hour | 1.98 | 1.12 | 0.75 |
| **Condensation ratio:** | **87.8** | **94.3** | **95.3** |

**TRAP No. 4.**
**Dunham No. 2, Liquid Thermostatic Type.**



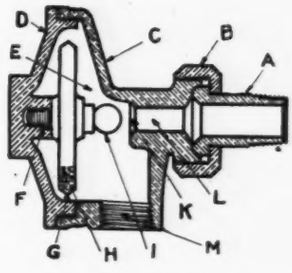
| Date of test | First test Aug. 26, '22 | Second test Aug. 25, '22 | Third test Aug. 25, '22 |
|---|---|---|---|
| Barometer reading, in. | 29.39 | 29.20 | 29.20 |
| Temperature readings, deg. F. | | | |
| Room (av.) | 78.0 | 85.8 | 82.2 |
| Radiator (av.) | 219.8 | 219.1 | 211.9 |
| Steam inlet (av.) | 220.6 | 220.3 | 212.5 |
| **Temperature ratio:** | **99.4** | **99.1** | **99.5** |
| Weights of water; lbs.: | | | |
| Total condensation | 58.21 | 51.98 | 49.36 |
| Condensation per hour | 19.40 | 18.35 | 17.42 |
| Total steam passed | 2.16 | 0.05 | 1.9 |
| Steam passed per hour | 0.72 | 0.02 | 0.67 |
| **Condensation ratio:** | **96.4** | **99.9** | **96.2** |

**TRAP No. 5.**
**Hoffman No. 8, Liquid Thermostatic Type.**



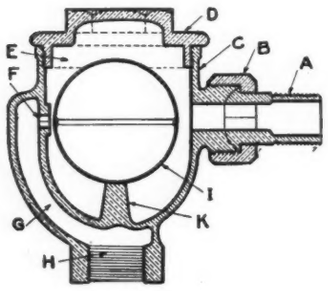
| Date of test | First test Aug. 24, '22 | Second test Aug. 23, '22 | Third test Aug. 23, '22 |
|---|---|---|---|
| Barometer reading, in. | 29.32 | 29.32 | 29.32 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 87.5 | 90.8 | 87.0 |
| Radiator (av.) | 218.7 | 218.5 | 211.4 |
| Steam inlet, (av.) | 220.5 | 220.5 | 212.7 |
| **Temperature ratio:** | **98.6** | **98.4** | **98.9** |
| Weights of water, lbs.: | | | |
| Total condensation | 42.94 | 44.91 | 44.57 |
| Condensation per hour | 15.15 | 15.85 | 15.73 |
| Total steam passed | 0.63 | 0.10 | 0.65 |
| Steam passed per hour | 0.22 | 0.03 | 0.23 |
| **Condensation ratio:** | **98.5** | **99.8** | **98.5** |

**TRAP No. 6.**
**Illinois Thermo, Liquid Thermostatic Type.**



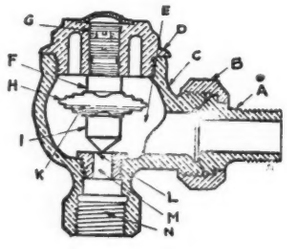
| Date of test | First test Aug. 22, '22 | Second test Aug. 22, '22 | Third test Aug. 23, '22 |
|---|---|---|---|
| Barometer reading, in. | 29.37 | 29.40 | 29.32 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 89.1 | 90.3 | 87.6 |
| Radiator (av.) | 215.9 | 217.5 | 210.3 |
| Steam inlet (av.) | 220.6 | 220.6 | 212.7 |
| **Temperature ratio:** | **96.5** | **97.6** | **98.0** |
| Weights of water, lbs.: | | | |
| Total condensation | 46.35 | 48.75 | 43.23 |
| Condensation per hour | 15.45 | 16.25 | 15.25 |
| Total steam passed | 1.35 | 0.20 | 0.53 |
| Steam passed per hour | 0.45 | 0.07 | 0.19 |
| **Condensation ratio:** | **97.1** | **99.5** | **98.7** |

**TRAP No. 7.**
**Johns-Manville Float Type.**



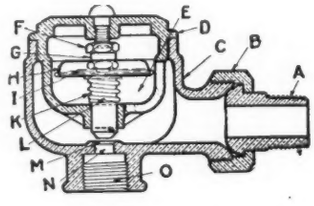

| Date of test | First test Aug. 1, '22 | Second test July 31, '22 | Third test Aug. 1, '22 |
|---|---|---|---|
| Barometer reading, in. | 29.45 | 29.45 | 29.45 |
| Temperatures, deg. F.: | | | |
| Room (av). | 84.8 | 85.0 | 99.4 |
| Radiator (av.) | 217.7 | 190.7 | 211.5 |
| Steam inlet (av.) | 220.7 | 220.7 | 212.8 |
| **Temperature ratio:** | **97.8** | **77.8** | **98.8** |
| Weights of water, lbs.: | | | |
| Total condensation | 51.99 | 38.65 | 43.53 |
| Condensation per hour | 17.33 | 12.88 | 14.51 |
| Total steam passed | 1.90 | 0 | 4.66 |
| Steam passed per hour | 0.63 | 0 | 1.55 |
| **Condensation ratio:** | **96.5** | **100** | **90.3** |

**TRAP No. 8.**
**Marsh Reflux No. 1, Liquid Thermostatic Type.**



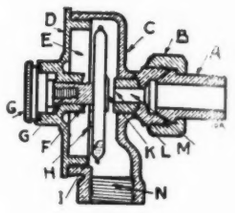

| Date of test | First test Aug. 10, '22 | Second test Aug. 29, '22 | Third test Aug. 5, '22 |
|---|---|---|---|
| Barometer reading, in. | 29.51 | 29.50 | 29.44 |
| Temperatures, deg. F. | | | |
| Room (av.) | 85.1 | 80.2 | 83.5 |
| Radiator (av.) | 218.3 | 217.8 | 210.1 |
| Steam inlet (av.) | 220.8 | 220.8 | 212.9 |
| **Temperature ratio:** | **98.1** | **97.8** | **97.8** |
| Weights of water, lbs.: | | | |
| Total condensation | 47.35 | 52.34 | 47.54 |
| Condensation per hour | 15.78 | 17.45 | 15.85 |
| Total steam passed | 1.60 | 0 | 0.35 |
| Steam passed per hour | 0.53 | 0 | 0.12 |
| **Condensation ratio:** | **96.7** | **100** | **99.2** |

**TRAP No. 9.**
**Monash No. 35 B, Liquid Thermostatic Type.**



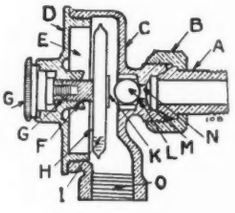

| Date of test | First test Aug. 4, '22 | Second test Aug. 3, '22 | Third test Aug. 4, '22 |
|---|---|---|---|
| Barometer reading, in. | 29.35 | 29.35 | 29.35 |
| Temperatures, deg. F. | | | |
| Room (av.) | 83.8 | 90.7 | 84.9 |
| Radiator (av.) | 216.7 | 218.9 | 210.5 |
| Steam inlet (av.) | 220.6 | 220.6 | 212.8 |
| **Temperature ratio:** | **97.1** | **98.7** | **98.2** |
| Weights of water, lbs.: | | | |
| Total condensation | 51.01 | 45.03 | 50.56 |
| Condensation per hour | 17.00 | 15.01 | 16.85 |
| Total steam passed | 1.05 | 0 | 0.48 |
| Steam passed per hour | 0.35 | 0 | 0.16 |
| **Condensation ratio:** | **97.9** | **100** | **99.0** |

**TRAP No. 10.**
**O-E Flat Seat, Liquid Thermostatic Type.**



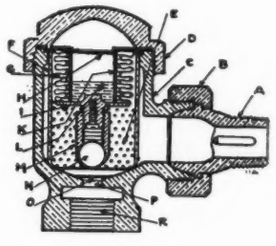

| Date of test | First test Nov. 11, '22 | Second test Nov. 10, '22 | Third test Nov. 13, '22 |
|---|---|---|---|
| Barometer reading, in. | 29.48 | 29.60 | 29.56 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 75.6 | 78.0 | 80.8 |
| Radiator (av.) | 216.7 | 213.5 | 211.9 |
| Steam inlet (av.) | 220.8 | 220.8 | 213.0 |
| **Temperature ratio:** | **97.1** | **94.8** | **99.1** |
| Weights of water, lbs.: | | | |
| Total condensation | 46.42 | 48.62 | 36.76 |
| Condensation per hour | 15.47 | 16.21 | 12.25 |
| Total steam passed | 0 | 0 | 0 |
| Steam passed per hour | 0 | 0 | 0 |
| **Condensation ratio:** | **100** | **100** | **100** |

**TRAP No. 10-B.**
**O-E Ball Seat, Liquid Thermostatic Type.**



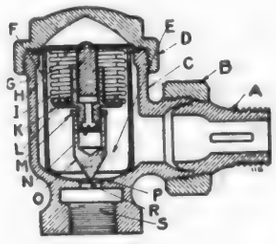

| Date of test | First test Nov. 16, '22 | Second test Nov. 16, '22 | Third test Nov. 17, '22 |
|---|---|---|---|
| Barometer reading, in. | 29.23 | 29.36 | 29.20 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 81.5 | 84.0 | 78.0 |
| Radiator (av.) | 214.5 | 214.8 | 207.3 |
| Steam inlet (av.) | 220.7 | 220.8 | 212.8 |
| **Temperature ratio:** | **95.5** | **95.6** | **95.9** |
| Weights of water, lbs.: | | | |
| Total condensation | 47.60 | 46.40 | 44.42 |
| Condensation per hour | 15.87 | 15.43 | 14.81 |
| Total steam passes | 0 | 0 | 0 |
| Steam passed per hour | 0 | 0 | 0 |
| **Condensation ratio:** | **100** | **100** | **100** |

**TRAP No. 11-A.**
**Type E Sarco (Old Model), Liquid Themostatic Type.**



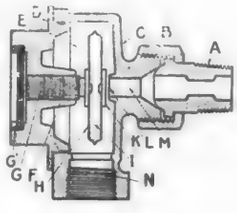

| Date of test | First test July 28, '22 | Second test July 27, '22 | Third test July 28, '22 |
|---|---|---|---|
| Barometer reading, in. | 29.5 | 29.45 | 29.5 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 87.0 | 90.5 | 89.7 |
| Radiator (av.) | 219.8 | 220.0 | 212.0 |
| Steam inlet (av.) | 220.8 | 220.7 | 213.0 |
| **Temperature ratio:** | **99.2** | **99.4** | **99.2** |
| Weights of water, lbs.: | | | |
| Total condensation | 50.60 | 49.37 | 44.52 |
| Condensation per hour | 16.87 | 16.45 | 14.84 |
| Total steam passed | 3.92 | 7.25 | 4.06 |
| Steam passed per hour | 1.31 | 2.42 | 1.35 |
| **Condensation ratio:** | **92.7** | **87.1** | **91.6** |

**TRAP No. 11-B.**
**Type E Sarco (New Model), Liquid Thermostatic Type.**



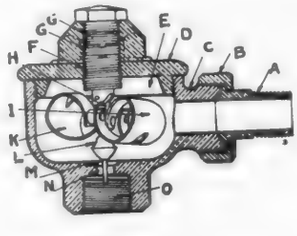
| Date of test | First test Nov. 7, '22 | Second test Nov. 8, '22 | Third test Nov. 9, '22 |
|---|---|---|---|
| Barometer, in. | 29.33 | 29.50 | 29.67 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 81.7 | 85.4 | 85.5 |
| Radiator (av.) | 219.6 | 220.0 | 213.0 |
| Steam inlet (av.) | 220.5 | 220.8 | 213.3 |
| **Temperature ratio:** | **99.3** | **99.3** | **99.7** |
| Weights of water, lbs.: | | | |
| Total condensation | 50.53 | 49.82 | 43.91 |
| Condensation per hour | 16.84 | 16.61 | 14.64 |
| Total steam passed | 1.5 | 0 | 0 |
| Steam passed per hour | 0.5 | 0 | 0 |
| **Condensation ratio:** | **97.1** | **100** | **100** |

**TRAP No. 12.**
**Sterling, Liquid Thermostatic Type.**



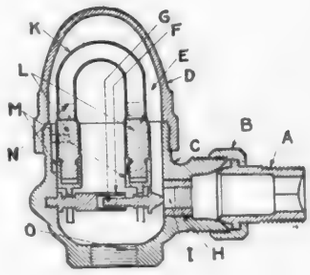
| Date of test | First test Aug. 7, '22 | Second test Aug. 7, '22 | Third test Aug. 8, '22 |
|---|---|---|---|
| Barometer, in. | 29.11 | 29.11 | 29.30 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 84.6 | 84.4 | 80.9 |
| Radiator (av.) | 217.3 | 218.4 | 208.9 |
| Steam inlet (av.) | 220.2 | 220.2 | 212.7 |
| **Temperature ratio:** | **97.8** | **98.6** | **97.1** |
| Weights of water, lbs.: | | | |
| Total condensation | 53.08 | 56.76 | 49.02 |
| Condensation per hour | 17.69 | 18.92 | 16.34 |
| Total steam passed | 2.40 | 0 | 0.10 |
| Steam passed per hour | 0.80 | 0 | 0.03 |
| **Condensation ratio:** | **95.6** | **100** | **99.8** |

**TRAP No. 13.**
**Trane, Solid Thermostatic Type.**



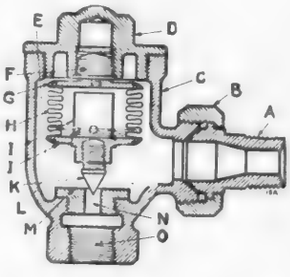
| Date of test | First test Aug. 21, '22 | Second test Aug. 12, '22 | Third test Aug. 11, '22 |
|---|---|---|---|
| Barometer reading, in. | 29.4 | 29.53 | 29.56 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 87.1 | 87.1 | 86.5 |
| Radiator (av.) | 217.1 | 216.9 | 210.9 |
| Steam inlet, (av.) | 220.6 | 220.8 | 213.1 |
| **Temperature ratio:** | **97.3** | **97.0** | **98.2** |
| Weights of water, lbs.: | | | |
| Total condensation | 46.46 | 49.78 | 43.27 |
| Condensation per hour | 15.49 | 16.59 | 14.42 |
| Total steam passed | 0.98 | 0 | 0.18 |
| Steam passed per hour | 0.33 | 0 | 0.06 |
| **Condensation ratio:** | **97.9** | **100** | **99.5** |

**TRAP No. 14.**
**Vento No. 1, Liquid Thermostatic Type.**



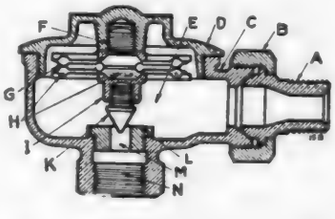
| Date of test | First test Aug. 2, '22 | Second test Aug. 16, '22 | Third test Aug. 2, '22 |
|---|---|---|---|
| Barometer reading, in. | 29.42 | 29.49 | 29.42 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 85.9 | 90.5 | 88.6 |
| Radiator (av.) | 212.9 | 213.8 | 209.5 |
| Steam inlet (av.) | 220.7 | 220.8 | 212.9 |
| **Temperature ratio:** | **94.2** | **94.6** | **97.2** |
| Weights of water, lbs.: | | | |
| Total condensation | 49.74 | 46.77 | 37.41 |
| Condensation per hour | 16.58 | 15.59 | 12.47 |
| Total steam passed | 0.91 | 0 | 0 |
| Steam passed per hour | 0.30 | 0 | 0 |
| **Condensation ratio:** | **98.2** | **100** | **100** |

**TRAP No. 15-A.**
**Webster Sylphon No. 512, Liquid Thermostatic Type.**



| Date of test | First test Aug. 15, '22 | Second test Aug. 14, '22 | Third test Aug. 14, '22 |
|---|---|---|---|
| Barometer, in | 29.43 | 29.43 | 29.43 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 90.0 | 91.7 | 88.2 |
| Radiator (av.) | 219.5 | 220.2 | 212.3 |
| Steam inlet (av.) | 220.7 | 220.7 | 212.8 |
| **Temperature ratio:** | **99.0** | **99.6** | **99.6** |
| Weights of water, lbs.: | | | |
| Total condensation | 49.02 | 48.15 | 46.09 |
| Condensation per hour | 16.34 | 16.05 | 15.36 |
| Total steam passed | 2.40 | 0.14 | 0.46 |
| Steam passed per hour | 0.80 | 0.05 | 0.15 |
| **Condensation ratio:** | **95.3** | **99.7** | **99.0** |

**TRAP No. 15-B.**
**Webster No. 712, Liquid Thermostatic Type.**



| Date of test | First test Nov. 2, '22 | Second test Nov. 1, '22 | Third test Nov. 3, '22 |
|---|---|---|---|
| Barometer, in. | 29.42 | 29.30 | 29.67 |
| Temperatures, deg. F.: | | | |
| Room (av.) | 79.9 | 86.0 | 82.2 |
| Radiator (av.) | 220.0 | 219.6 | 212.6 |
| Steam inlet (av.) | 220.7 | 220.5 | 213.2 |
| **Temperature ratio:** | **99.5** | **99.3** | **99.5** |
| Weights of water, lbs. | | | |
| Total condensation | 54.64 | 47.68 | 44.70 |
| Condensation per hour | 18.21 | 15.89 | 14.90 |
| Total steam passed | 2.2 | 0.12 | 0.45 |
| Steam passed per hour | 0.7 | 0.04 | 0.15 |
| **Condensation ratio** | **96.2** | **99.7** | **99.0** |

# Estimated Heating Requirements Checked With the Actual Heat Input

Interesting details are now available of the methods used in estimating the heating requirements of the Canadian Cotton Company's plant at Milltown, N. B., and how accurate these turned out to be when checked with the actual heat input. This comparison was comparatively easy as the plant is heated by electricity; illustrations of the building and of the type of electric heater units used were published in THE HEATING AND VENTILATING MAGAZINE for May, 1923.

The weave shed (built in 1920) is a one-story building (with basement) 480 ft. long by 182 ft. wide of modern mill construction with monitor roof. The basement walls are of concrete and those of the weave room of brick. The basement floor is of concrete, that of the weave room and the roof are of plank construction with timber and wooden column supports. The south end of the shed butts against the three-story main mill while the rest of the building is all exposed and lies north by northwest. The basement is used for storage and the first floor for a weave room.

### METHOD OF HEATING.

The method of heating adopted is the Sturtevant fan blast system with groups of electric heating units instead of steam coils in the fan room. Two such groups are installed in the basement; one at the north and one at the south end.

Each of the two groups is enclosed in a fireproof room, with the air distributing fan intake connected therewith, the discharge being connected to the distributing pipes for the weave room. The air from the weave room is drawn down through belt holes in the floor into the basement, and thence into the heating room inlets by the suction of the fans.

**St. Croix Mill, Canadian Cotton Company, Milltown, N. B. Weave Shed in Foreground.**

A continuous record test was made on the heating system from Mar. 9 to April 5, 1922.

The calculated requirements, as given below, were included in a paper by C. T. Guildford, general engineer of the Westinghouse Electric & Mfg. Company, presented at the recent spring convention of the American Institute of Electrical Engineers. They were obtained for each case by using the temperature differences as observed, and these results were compared with the actual input readings for that period.

The constants used, B. T. U. per square foot of area per degree difference of temperature per hour, are as follows:

| | |
|---|---|
| Glass | 1.00 |
| Walls, weave room | 0.31 |
| Walls, Basement | 0.30 |
| Roof | 0.10 |
| Number of air changes per hour in weave room | 0.75 |
| Number of air changes per hour in basement | 0.25 |

Air equivalent to one B. T. U. 50 cu. ft. raised 1° or 1/50 = multiplier of 0.02

**Interior of Weave Shed, Showing Warm Air Distributing Pipes Overhead.**

*Building Specifications—Weave Room*

| | |
|---|---|
| Cubical contents | 1,260,000 cu. ft. |
| Total glass area (walls and monitors) | 12,255 sq. ft. |
| Area of roof and monitor walls | 84,000 sq. ft. |
| Area of building walls | 9,270 sq. ft. |

*Basement:*

| | |
|---|---|
| Cubical contents | 675,000 cu. ft. |
| Total glass area | 2,450 sq. ft |
| Exposed area walls | 4,120 sq. ft. |

In using the above low value for the roof constant it was assumed that, on account of the hot air being drawn down through the floor, the temperature difference between outdoors and indoors over this surface was considerably less than that observed in the room.

The air changes selected were assumed to take place at all times due to leakage through crevices at windows, doors, etc.

Selecting the temperature difference, of 58.75° F. for the weave room and 53.75°, for the basement, observed on Friday, March 17, when the extreme low temperature for the day was 8° and for the night, 6°, the calculated requirements for that day were as follows:

Let H = B. T. U. per hour.

*Weave Room:*

H = (0.02 × 0.75 × 1,260,000 + 12,255 + 0.31 × 92 P + 0.1 + 84.000) 58.75 = 42,428 × 58.75 = 2,492,-645 B. T. U. per hour

*Basement:*

H = (0.02 × 0.25 × 675,000 + 2450 + 0.31 × 4120) 53.75 = 7102 × 53.75 = 381.733 B. T. U. per hour.

Total heat required = 2,492,645 + 381,733 = 2,874,378 B. T. U. per hour.

Deducting from this the heat developed by the 237 operators at 470 B. T. U.=111,390 B. T. U. per hour, 225 kw. of power for looms=768,375, making a total of 879,765 B. T. U. per hour, or (879,765×10)÷24=366,-568 B. T. U. per hour on 24 hours basis. 38 kw. of power for heater fans=129,770 B. T. U. per hour during 24 hours, making a grand total of 496,338 B. T. U. per hour. The net calculated heat to be furnished by the heaters=2,874,378—496,338=2,378,000 B. T. U. per hour on 24 hours basis.

The actual input to the heaters for this day from 6 A. M. to 6 A. M. the next morning, normal working day and night, was 16,700 kw-hours, or 16,700÷24= 695.8 kw., or 695.8×3415=2,376,157 B. T. U., which is within a fraction of 1% of the calculated value.

The calculated heat requirements per hour for a period of fifteen working days and nights following between March 9 and April 4, with an average temperature difference (day and night) of 45.25° and 40.25° for the weave room and basement, respectively, was:

*Weave Room:*

H=42,428×45.25°=1,919,867 B. T. U. per hour.

*Basement:*

H= 7,102×40.25°= 285,855 B. T. U. per hour.

Total =2,205,722 B. T. U. per hour.

Net heat=2,205,722—496,338=1,709,384 B. T. U. per hour.

The actual average daily kilowatt input for this period was 9150+3214=12,364 kw-hours., or 12364÷24× 3415=1,759,294, B. T. U. per hour, which is within 3% of the calculated value.

COMPARISON BETWEEN DAY AND NIGHT HEATING

The average heat required during the night for this 15-day period is found to be 44% greater than that required during the day, even after due allowance is made for the heat supplied by power and the operators. This is accounted for partly by the fact that the average night temperature difference was 3.5° greater than that for the day. This would reduce the excess to 31%; which excess may be explained by the fact that weather conditions during the days for the entire period of the test and also for the fifteen days in question showed an average of 54% of sunshine, many days being 100%.

## New Ideas in Hospital Heating

For hospital purposes the heating system should be separate from the ventilating. In very few hospitals have they been found to work well combined. Most of the mechanical systems in America have fallen into disuse. The favorite system of heating is by means of hot water. Certain hospitals are trying out oil as fuel. Small wards should be provided where nephritics and diabetes may be kept particularly warm. Rooms for pneumonia and all tuberculous affections should be provided with cool, fresh air, while patients with certain bronchial and laryngeal affection should be placed in rooms in which the air is moist.—JOHN N. E. BROWN, M. D., *formerly Superintendent of the Henry Ford Hospital, Detroit, and of the Toronto General Hospital, in The Hospital World.*

## Operantig Costs of Chicago Schools

A study of the operating cost given in Tables 1 and 2, will show the importance of adopting every proper means of reducing them. In considering these tables of costs, it must be borne in mind that as Chicago schools are cared for on the so-called indirect employment system, the item *salaries* includes the salaries of the engineering and janitorial force, and the item *supplies* includes both engineering and janitor supplies.

TABLE 1. APPROXIMATE COST PER ANNUM PER PUPIL—ELEMENTARY DAY SCHOOLS

| Year | Fuel | Operation Supplies | Operation Salaries | Total Operation | Total Educational Including Operation |
|---|---|---|---|---|---|
| 1917 | $2.05 | $.17 | $3.97 | $6.19 | $44.30 |
| 1918 | 2.70 | .17 | 4.30 | 7.17 | 47.95 |
| 1919 | 1.96 | .19 | 4.37 | 6.52 | 53.48 |
| 1920 | 3.20 | .21 | 5.20 | 8.61 | 62.87 |
| 1921 | 2.80 | .22 | 6.21 | 9.23 | 70.37 |
| 1922 | 2.45 | .22 | 6.17 | 8.84 | 71.51 |

TABLE 2. APPROXIMATE COST PER 1000 CU. FT. OF HEATED AND VENTILATED SPACE—ELEMENTARY DAY SCHOOLS

| Year | Fuel | Operation Supplies | Operation Salaries |
|---|---|---|---|
| 1917 | $2.41 | $.20 | $4.66 |
| 1918 | 3.18 | .20 | 5.07 |
| 1919 | 2.22 | .21 | 5.04 |
| 1920 | 3.83 | .25 | 6.24 |
| 1921 | 3.47 | .27 | 7.72 |
| 1922 | 3.07 | .28 | 7.73 |

JOHN HOWATT, *before the American Society of Heating and Ventilating Engineers.*

## Dust One of Industry's Greatest Hazards

Dust is a hazard in industry to an extent which has not been fully understood. The dust of any combustible substance may under certain conditions become an explosive. There have, for instance, been very serious explosions in flour mills.

Manufacturers need no longer wait for an explosion in their plants to demonstrate that the dust produced is dangerous, but can send a sample to the Bureau of Chemistry, Department of Agriculture to be tested. Suitable recommendations for safety will be supplied if the dust is dangerous.

# Legal Aspects of Installation Contracts

## A Review of Important Decisions In Heating and Ventilating Cases

By A. L. H. Street

SUPPLEMENTING an article which appeared in THE HEATING AND VENTILATING MAGAZINE for October, 1922, we refer to additional decisions of courts of last resort on matters of peculiar interest to heating and ventilating engineers and contractors. Obvious object lessons are deducible from the experience developed in these cases.

Lesson No. 1 treats of the importance of safeguarding the heating and ventilating contractor against loss of partly completed work through fire or other casualty, and arises from the decision handed down several years ago by the Illinois Supreme Court in the case of Huyett & Smith Manufacturing Co. vs. Chicago Edison Co., 47 Northeastern Reporter. In that case plaintiff was held not to be entitled to recover for work done toward installing a ventilating system before the building in which it was being installed was burned. The contract provided for erection of the equipment for a lump sum "payable thirty days after the completion and acceptance of the installation." While the job remained uncompleted, although work and materials covering about two-thirds of the contract price had been furnished, the building and this work were destroyed in a fire attributable to the fault of neither party.

A trial judge ruled that the plaintiff was entitled to recover for the work and materials so furnished, but the Supreme Court ruled against the right of recovery, saying, in part:

"As we understand the contract, the materials which the appellant [the contractor] furnished at or in the building never became the property of the appellee [the owner]. They were destroyed without the fault of appellee, and upon what principle the plaintiff could recover . . . for the value of the materials furnished and labor performed, we do not perceive. . . . The rule is well settled that, where labor has been performed under an express contract, a recovery must be had, if at all, on the contract. If the contract had been separable, providing for the payment of a certain sum of money at a specified date upon the delivery of certain articles in the building, the plaintiff, so far as it had been performed, might be entitled to recover, but such is not the contract. On the other hand, the contract is entire, providing that appellee was to be paid $1,360 thirty days after the completion and installation of a ventilating system in the building in accordance with certain plans and specifications. . . . The contract was entire, and no recovery could be had by appellant unless it fulfilled the contract, which was never done.

### SUBSTANTIAL PERFORMANCE OF CONTRACTS.

But another decision of the same court shows that an owner may not refuse to accept and settle for work which has been substantially completed and which remains unimpaired except as to minor deficiencies. That decision was handed down by the court in the case of Mills vs. Shepard, 50 Northeastern Reporter, 709. Plaintiffs were held to be entitled to recover for installing heating apparatus under a rule stated as follows:

"There were many details of minor importance to be complied with by appellees [plaintiffs] to carry out the contract, but it could not, in reason, be contended that no recovery could be had unless there was a literal compliance with the contract in respect to them. The rule is correctly laid down in Keeler v. Herr, 157 Ill. 57, 41 N. E. 750, that a literal compliance with such contracts is not necessary to a recovery, but it will be sufficient that there has been an honest and faithful performance of the contract in all its material and substantial particulars, and no omission in essential points, or willful departure from the contract; and mere technical or unimportant omissions will not defeat a recovery of the contract price, less any damages, however, requisite to indemnify the owner."

Another point decided in favor of the heating contractors in this same case concerned the remedy available to them to enforce their claim for the amount due. The contract provided that the title to the heating apparatus should remain with the contractors until full payment of the contract price, and that, on default in payment, they could remove the apparatus from the building. It was argued on the part of the owner that since one-half of the price remained unpaid, there was no delivery of the equipment, in a legal sense, and that the contractors were limited in their recourse to a removal of the apparatus and a claim for damages as for breach of the contract.

"We do not agree to this view of the case," observed the court. "The provision in question was for the benefit of appellees to secure the payment of the purchase money, and they had the clear right to waive it—to treat the title as having passed—and rely on their action at law to recover the balance, if any, due them. . . . It was waived by bringing this action in a form which treated the contract as having been fully performed, and the title to the heating apparatus as having passed to appellant."

### RIGHT TO PARTIAL PAYMENTS.

Where it is desired that payments be made in advance of completion of installation, express provision to that effect should be inserted in the contract. And, in the face of a written contract which indicates a mutual understanding that payment is to be made only on complete performance, the contractor will not be permitted to rely upon a concurrent verbal agreement or custom as entitling him to partial payments as the work progresses. These principles have been applied so frequently by the courts in litigation, arising under building contracts, that they have become well established rules of law. And they were specifically applied to a contract to install a heating plant in the case of Riddell vs. Peck-Williamson Heating and Ventilating

Co. 69 Pacific Reporter, 241, decided by the Montana Supreme Court.

This contract provided for payment according to a fixed schedule of prices, but did not specify when payment was to be made. After doing work amounting to more than $9000, the contractors ceased performance because the owner refused to make payment on account. The work left undone amount to more than $2000. The contractors relied upon a concurrent verbal agreement that payments should be made as the labor and materials were measured in the building and approved by the architect. Reliance was also placed upon a local custom entitling them to such payments. The Supreme Court ruled that the contractors were not entitled to recover for the work done, saying:

"Upon its face the contract is entire, and the consideration single. The intention of the parties, as disclosed and evidenced by the terms of their engagement reduced to writing, was that the defendant should not become indebted to Suiter unless and until he furnished all the material and did all the labor specified in the contract. There was in the contract no time expressly appointed for payment, but the law made the price due and payable upon complete performance. . . . Substantial performance . . . was a condition precedent to the company's liability under the express contract to pay the whole or any part of the consideration. . . . The fixing of prices upon the different items did not operate as a severance; it was a mere means of ascertaining the total compensation to be paid in the event Suiter executed the undertaking."

It was held that the trial judge erred in permitting the introduction of evidence tending to establish the verbal agreement and custom relied upon by the contractors. The holding was made under a well-established rule of law that oral promises, agreements, etc., are not admissible to contradict the terms of a written contract if made prior to or contemporaneously with the execution of the written contract.

It was further decided that the contractors could not ignore their contract and make claim for the reasonable value of the work and materials furnished by them. The court said:

"The fact that the defendant received the benefit of labor and material of the stipulated price of $9,312.96 does not raise an implied promise to pay for them. There was no severance of the original contract, nor apportionment of the consideration. The labor and materials necessarily went into and became constituent parts of the buildings, and could not be returned. The defendant having no privilege or power to return them, the benefit therefrom was not voluntarily retained."

### RESPONSIBILITY FOR DEFECTIVE RESULTS.

In entering into a contract, the contractor should bear in mind that he is assuming certain responsibilities concerning the effective working of the plant which he is to install. Limitations upon his responsibility should not be left in doubt. If there is any likelihood that ventilating or heating apparatus, although well constructed, may prove inefficient, the contractor should carefully safeguard himself by appropriate contract stipulations, unless he is willing to accept responsibility for conditions producing the inefficiency.

The broad responsibility that follows an unqualified undertaking to install a heating plant in "a good and workmanlike manner" is shown by the decision handed down by the Iowa Supreme Court in the case of Ideal Heating Co. vs. Kramer, 127 Iowa Reports, 137. In that case, plaintiff's suit to recover for heating installation was defeated on the ground that the work was not properly done. Plaintiff insisted that it had complied with its undertaking to install the plant in "a good and workmanlike manner," and that it did not undertake to accomplish any certain or definite results with the apparatus. The court said:

"In our judgment, the plaintiff, in agreeing to do the work 'in a good and workmanlike manner,' did undertake to produce definite and certain results. The stipulation means something more than a promise to do a job which shall look well—something more than a good example of pipe fitting. A grist-mill which will not grind, a reaper that will not cut grain, a locomotive that will not move when the power is applied, can hardly be said to be constructed in a good and workmanlike manner. Even so a heating apparatus that will heat nothing but the owner's temper must be said not to fill that condition. . . . A good and workmanlike job is one that is done as a skilled workman should do it.

"The putting in of a steam heating outfit is a work which requires experience and skill. When such work is well done, we know, as a matter of common knowledge, it serves its purpose with a fair degree of success. It is made evident in this case that the plan adopted for piping and heating the defendant's residence did not operate with reasonable success. For one thing, it is practically conceded that the boiler was set too high to permit a return of the condensed steam, with the result that the pipes and radiators would fill with water and prevent the circulation of steam. Plaintiff sought to remedy this by wasting the condensed steam into the sewer, but the device did not operate satisfactorily. When the existence of the defect was demonstrated, plaintiff refused to lower the boiler without extra payment. [The boiler was located in a building adjacent to the dwelling house, in which radiation was installed]. And the defendant, after vainly trying to heat his house therefrom, abandoned the attempt, and put in a furnace and notified plaintiff to remove the radiators and pipe. If the boiler was too high, plaintiff, as a skilled workman, must have known the fact, and must further have known that a good and workmanlike job for heating the defendant's home therefrom was impracticable. It is testified upon part of the plaintiff's officers that before entering into the contract they expressed to defendant their doubt of the success of an attempt to heat the house in the manner proposed, and told him that he must take his chances, or words to that effect. If this fact were established, it would, of course, relieve the plaintiff from responsibility, for, under such circumstances, it could only be held to make as good a job as could reasonably be expected in view of the faulty plan adopted."

But the court found that the weight of the evidence favored defendant's claim that no such conversation occurred, particularly since "it would seem improbable that, in face of a warning that his heating apparatus was likely to prove valueless, he would direct or permit the work to proceed."

# Burning Liquid Fuel in Small Heating Plants

## A Study of the Various Methods Now in Use, with Chart for Determining Efficiency of Any Oil Burner and Furnace

By Walter J. Ottinger, M. E.

IF natural gas could be had in unlimited quantities at a reasonable price, there is no question but that it would be the ideal fuel for heating, as well as cooking. However, the quantity and quality of the supply is steadily becoming lower, while the price is rapidly increasing. This condition, together with the unsteadiness of the supply when it is most needed, make it out of the question to depend upon gas alone for fuel.

Nobody really enjoys burning coal. The house is overheated or underheated most of the time, and the ashes are always to be reckoned with. Of late years, labor troubles have made it difficult to obtain good quality coal at any price.

As a result of these conditions, oil heat is rapidly being adopted, at least in certain sections of the country. In general, the advantages of oil over gas for heating are the lower price of the fuel and the certainty of the supply. Gas at a low price and plentiful supply is the ideal fuel—nobody questions that. The problem is to get the gas.

### ADVANTAGES OF OIL OVER COAL

In general, oil for fuel has a number of very distinct advantages over coal. Some of them are:

Cleanliness; oil is clean and free from dust.

Space economy; for equal heat content, oil occupies 50% less space and has 25% less weight.

No disintegration or loss of heat value in storage.

Labor saving; oil has much lower handling cost.

Storage much more convenient; oil may be stored in any size or shape container at any convenient location.

Higher efficiency; no loss of combustible in the ash, as with coal, and better control of the air supply and more thorough mixture of air and fuel insure more nearly perfect combustion.

Better sustained efficiency; no loss due to admission of cold air when doors are opened as for firing coal, cleaning fires, removing clinkers and ashes, etc.

Greater flexibility; intensity of fire can be instantly regulated to meet fluctuating loads.

No loss from banking fires.

Smoke may be entirely eliminated.

Smaller stack is required than for coal.

In residences and other small heating plants, the advantages of oil over coal become pronounced. Here the cleanliness of liquid fuel, the convenience, and the ease with which results can be controlled by the home owner, become of first importance. When these advantages can be combined an operating cost as low or lower than that of coal, it is no wonder that great strides have been made in the use of oil for home heating.

### FIVE GENERAL CLASSES OF OIL BURNERS

There are many designs of oil burners on the market, but they may all be classified in certain general types and their subdivisions. In general, the types of oil-burning equipment are as follows:

1. *Stationary Nozzle, Oil Under Pressure. All Atomizers.*
   - A. Oil Sprayed Directly Out of Orifice.
     - *a.* Set nozzle, no adustment.
     - *b.* Various shape nozzles and orifices.
     - *c.* No steam or air to aid atomization.
     - *d.* Heavy power required for pumping and atomizing oil.
     - *e.* Simple design.
     - *f.* Likely to be inefficient unless air is closely controlled.
     - *g.* Variations in design have a screw or worm in oil line at orifice, to give a whirl to the oil spray.
   - B. Oil Pumped Directly Out of Orifice. Air or Steam Blast Out of Another Orifice.
     - *a.* Set or adjustable nozzle.
     - *b.* Usually the oil flows through the upper slot, air or steam through the lower slot.
     - *c.* Simple in construction and operation.
     - *d.* Durable.
     - *e.* Very noisy.
     - *f.* Sometimes called locomotive burners because they are much used on oil-burning locomotives.
   - C. Oil Pumped Out of Orifice. Air Out of Orifice Around Oil Tube.
     - *a.* Set or adjustable nozzle.
     - *b.* May have a screw or worm in the oil orifice.
     - *c.* May have vanes in air pipe to twirl air supplied for combustion.
2. *Rotating Nozzle, Only Enough Oil Pressure to Feed Fuel Into the Rotating Cup.*
   - A. Direct Motor-Driven Cup, Fan on Same Shaft.
     - *a.* Small adjustment of air at nozzle is usually possible.
     - *b.* Cup is always placed on a horizontal axis.
     - *c.* Oil pump may be integral, usually worm-driven from the motor shaft, or
     - *d.* There may be a separate oil pump, driven by independent motor, turbine or pulley, or
     - *e.* Gravity feed is occasionally used.
     - *f.* Several burners may be fed from one source, whether pressure or gravity.
   - B. Gear-Driven Cup, Fan on Same Vertical Shaft as Oil Sprayer.
     - *a.* A circular built-up combustion chamber is used.
     - *b.* The motor is connected to a horizontal shaft, outside of the ashpit door of the furnace.

*c.* Ball or roller bearings are usually used.

C. Horizontal Air-Driven Cup, Operated by Screw or Turbine Vanes on Outside of the Cup.

*a.* Cup is mounted on ball bearings, so as to be as nearly frictionless as possible.

*b.* Air and oil are supplied by motor or turbine driven blower and pump set.

*c.* Air adjustment may be made at nozzle or by damper.

*d.* Oil adjustment by throttle valve or by automatic pressure-relief valve.

*e.* One rotary power unit may serve several nozzles.

D. Water-Driven Cup, Vertical, Operated by City Water Pressure

*a.* Construction inside furnace is similar to "B."

*b.* The water motor is usually located on the vertical shaft directly below grates on which whirling cup sets.

3. *Stationary Nozzle, Oil Not Under Pressure. All Atomizers.*

A. Oil Drawn From a Level Through an Aspirator:

*a.* By velocity of air.

*b.* By velocity of steam.

4. *Burners With Attached Combustion Chambers.*

A. Set Nozzle, No Adjustment at Nozzle.

*a.* Oil is atomized before it reaches the combustion chamber.

B. No Nozzle, Oil Pumped Directly into Combustion Chamber.

*a.* Oil is vaporized by a hot plate in the combustion chamber.

*b.* The flow of oil is controlled by a solenoid valve.

5. *Gravity Burners.*

A. Oil flows by gravity directly to the burner.

B. The air supply is independent of the oil supply, varying with atmospheric conditions.

### NOTES ON SELECTION OF BURNERS

Many very successful industrial burners are not at all satisfactory for residence heating. The types which spray the oil directly, for example, are ruled out because of their excessive noise and heavy power requirements. Where air is mixed with fuel at or in the nozzle, these objections are greatly modified, and burners of this type are in use for domestic heating. They seem to be fairly quiet in operation, but wasteful of fuel on account of requiring a high excess of air to make sure of a thorough mixture of air and oil. Cutting down the excess does not help, as the stack is liable to become overheated due to carbon monoxide from unburned fuel igniting in the chimney.

The rotating nozzle burners, which have been very successful in large furnaces, have been adapted with some success to smaller heating boilers. They are better than the stationary nozzle types in that they give a atomization of the fuel and consequently more efficient finer atomization of the fuel and consequently more efficient combustion, but, like the former, they still require considerable power to operate the pumps and blowers.

### BRICKED-IN COMBUSTION CHAMBERS REQUIRED

Bricked-in combustion chambers are required with both of the foregoing types. In large furnaces this makes comparatively little difference, but in small heating boilers the efficiency is seriously cut down when the amount of effective heat-absorbing surface, none too large at best, is still further cut down. The rotating nozzle burners give best results in boilers having long combustion chambers. Inasmuch as the burners are not operating at highest efficiency until the combustion space is at a high temperature, they are better adapted to constant operation than to intermittent off-and-on operation as when controlled automatically by an electric thermostat.

### FUEL REQUIREMENTS FOR DOMESTIC HEATING

The fuel requirements for domestic heating are:

1. The fuel should be not less than 30° Baumé, preferably nearer 40°. This will insure free flow through pipes and burner, starting cold under any weather conditions likely to be encountered.
2. Must be a clear petroleum product, with the smallest possible amount of moisture and residue. This will reduce probability of trouble due to sputtering flame, carbonizing, or clogging of pumps, pipes or nozzles.
3. The flash point should not be more than 175° F., to insure ignition; and it should not be less than 150°, for the sake of safety.
4. The foregoing will take care of the burning point, which should be between 200° and 250° F.
5. The supply of the fuel must be ample and dependable.

### POINTS TO BE COVERED BY OIL-BURNING EQUIPMENT

The oil-burning equipment must be:

1. Absolutely dependable, under service conditions.
2. It must be efficient and economical. The power requirements should be as small as possible, likewise the consumption of fuel, gas and electricity, consistent with results.
3. It should be simple in construction, easily understood by the owner, with few adjustments and the smallest possible number of moving parts.
4. It must operate at a high sustained efficiency.
5. It must be clean, operating without odor, smoke, soot, or spilled fuel.
6. It must be absolutely safe, under all conditions. Preferably the burner should have the approval of the Underwriters' Laboratories of the National Board of Fire Underwriters, and, at any rate, the installation itself should have the approval of the local fire prevention authorities.
7. The burner should have automatic control, so that any desired temperature or pressure will be maintained, regardless of weather conditions.
8. It must be quiet in operation, at least to such an extent as not to disturb the members of the household.
9. The equipment must be thoroughly well designed and engineered, so that the user will not be

forced to do the manufacturer's experimenting for him. No oil-burning equipment should be placed on the market until in its final form it has gone through at least a season of successful home heating.

10. It must be rugged and foolproof, having all moving or adjustable parts enclosed, to protect the burner and the user as well, against tampering.
11. Finally, as with any mechanical device, the burner should be backed by a competent service organization, prepared at any time to answer emergency calls. This presupposes a well-manned and financially responsible local agency for the equipment.

It will now be of interest to consider the several types of oil burners in use for domestic heating, with the advantages and disadvantages of each type.

### FEATURES OF STATIONARY AND ROTATING NOZZLE BURNERS

Considering first the stationary nozzle burners, with no integral combustion chamber; the burner itself is very simple both in construction and in operation, but with the moderate pressure allowable in domestic heating, the atomization of the fuel is likely to be incomplete. This makes it necessary to use considerable excess air to insure thorough mixture and complete combustion,

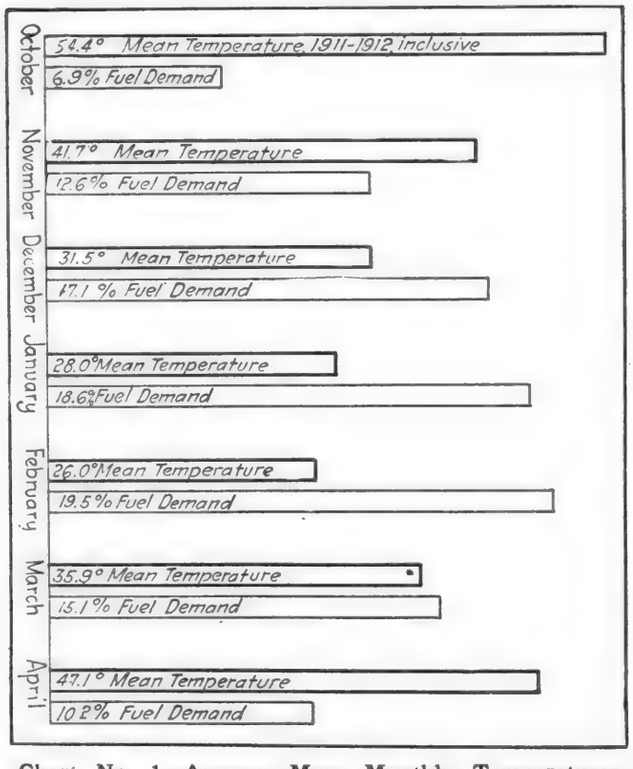



**Chart No. 1—Average Mean Monthly Temperatures and Corresponding Fuel Demand.**

and this in turn leads to high fuel combustion. This condition is aggravated by the necessity of cutting down the heat-absorbing surface of the boiler with brick.

The rotating nozzle burners are comparatively simple in construction and operation, give thorough atomization to the oil and they consequently require much smaller excess of air to get complete combustion. They respond readily to small adjustments of both air and oil supply, such as automatic control by steam pressure or by expansion thermostat. These burners were not originally designed for operation with pilot light and electric thermostat, and they are not so well adapted to off-and-on control as are other types with integral combustion chambers. The principal disadvantage of the rotary nozzle burners in small installations is that the intensity of the flame requires bricking in, with consequent loss of valuable heat-absorbing surface.

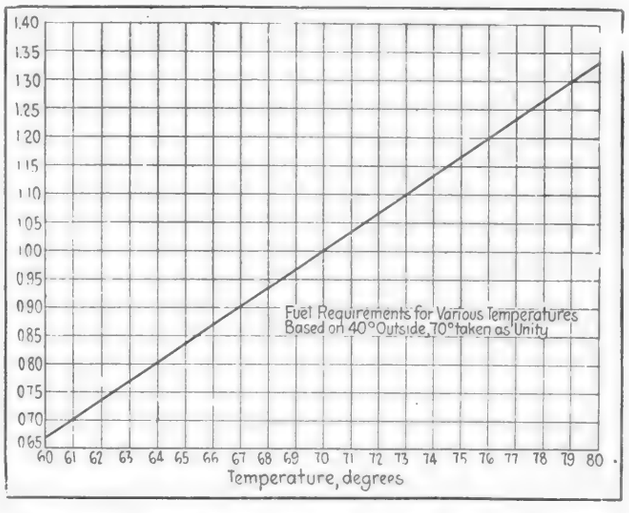



**Chart No. 2—Fuel Requirements for Various Indoor Temperatures, with 40° F. Outside.**

Where the combustion chamber is integral with the burner, the flame is confined and controlled, and the burner can be so placed that the full effect of the radiant heat is secured. Regardless of the shape of the furnace, uniformly thorough mixing of the oil and air is obtained. No bricking in is required, so there is no loss in heat transmission from this source. As the combustion chamber is comparatively small, it is rapidly heated, so that with automatic off-and-on control, there is the smallest possible period of low efficiency in starting from a cold furnace. With most makes of this type, the burner can be readily "pulled" in case of emergency, and the furnace re-equipped for coal in a comparatively short time.

### COMBUSTION CHAMBER SUBJECTED TO SEVERE SERVICE

The severe service of the combustion chamber demands a material capable of withstanding immense expansion and contraction strains, without warping or cracking. In some burners fireclay chambers are used, while in others metal combustion chambers are employed. Provided an alloy can be secured which will stand up to the work, there is no question about metal being the ideal material for the combustion chamber. It heats most quickly and it holds its shape.

With this type burner, any solid deposits, due to improper adjustment, impurities in the fuel, or any other causes, will be made in the combustion chamber, from which they may be readily removed. In general, this is preferable to carbon deposits on the heating surfaces; but in case of neglect it may become a disadvantage, should excessive carbon deposits be made in the combustion chamber, interfere with the flame and cause a "low fire" or, as it is often called, a "pot fire."

### DIFFICULTIES WITH GRAVITY BURNERS

Gravity burners are justified only by their initial low cost and their simplicity of construction. They may be easily controlled by hand, and at first they seem to have the advantage of requiring no source of power other than the chimney draft. As this, however, is a very variable quantity, the proportion of oil and air is seldom if ever just right, and as a result the burners are likely to smoke, smell, use up a lot of oil, and go out at the most inopportune times. In general, gravity burners are not at all reliable, because they are basically unsound in principle.

All oil burners, whether full, semi or non-automatic, should, in the interest of public safety, be provided with an effective automatic shut-off, so that there is no possibility of leakage of oil onto the basement floor. Local authorities should prevent installation of burners not provided with such devices.

### RELATION BETWEEN TEMPERATURES AND FUEL REQUIREMENTS

Most home owners, and too many heating engineers, are not entirely clear as to the relation between temperatures and fuel requirements for different conditions. To show these relations graphically the following charts have been worked out: Chart No. 1 shows the average mean monthly temperatures, as given by the Cleveland weather bureau for the past eleven years, while alongside of each temperature is a length representing the corresponding percentage of the season's fuel supply demanded by that temperature.

The second chart (Chart No. 2) shows the relation of the fuel requirement to keep a house at various temperatures, to the quantity of fuel needed to maintain the same house at 70° F. The outside temperature is assumed to be 40°, which is about the mean during the heating season in the north central portion of the country. The owner can determine at a glance how much more it costs him to pamper himself with 7° or 8° or 10° higher than 70°, or how much he can save by cutting down the temperature of his rooms.

In the third chart (Chart No. 3) is shown something which, the writer believes, has never before been worked out for oil fuel. A chart has been worked out for carbon, as this is ordinarily used for coal combustion. Oil, however, contains considerable hydrogen, so that the ordinary coal chart is of no value. While the chart was worked out with the lighter distillates in mind, it will hold with negligible error for all fuel oils. There is very little variation in the chemical make-up of American fuel oils suitable for small heating plants, so that the upper horizontal table, "Efficiency of Heat Absorption in Furnace or Boiler" can be used without change. The variation in heat content in the lighter and heavier oils can be taken care of by applying the ratio of B. T. U. per pound in the two oils under consideration (the one in use and the light distillate on which the table is based) to the lower horizontal table, "Heat Carried Away in Flue Gases, B. T. U. per Pound Oil Burned.'

The last chart (Chart No. 3) was originally made up with the object of supplying a rapid and accurate method for determining the efficiency of any oil burner and furnace or boiler combination, under service conditions, with the minimum of inconvenience to the home owner and of time to the engineer making the determination. It supplies the same results as a complete boiler test, at least so far as the owner is concerned, without submitting him to the inconvenience of breaking his water, oil or steam connections to weigh the liquids involved.

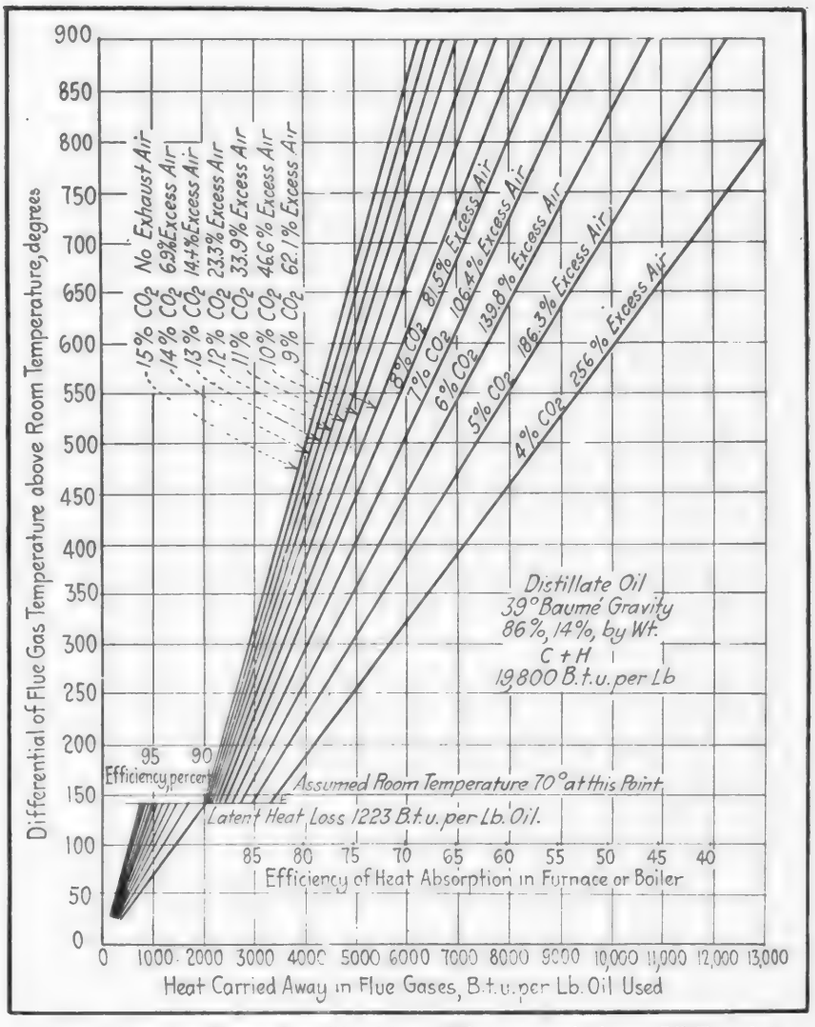



**Chart No. 3—Chart for Checking Efficiency of Any Oil-Burning Installation.**

With the aid of this chart, all that is necessary to secure the data to determine the efficiency of any installation is to drill two small holes in the flue near the boiler. In these holes are inserted an orsat apparatus and a thermometer. With the temperatures in the flue and in the room known, as well as the $CO_2$ content of the flue gases and the corresponding excess air, it is a simple matter to find the heat loss and the efficiency of the burner and boiler or furnace. When possible to obtain recording instruments, and to leave them unattended for a run of 24 hours or more of normal operation by the owner, this is the ideal method of obtaining data.

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IT IS becoming perfectly clear that one of the principal difficulties in connection with the apprenticeship problem is the attitude of the young men themselves in this day and generation which leads them to shy at those occupations which require manual work and the wearing of overalls. There has also grown up a decided distaste towards the term "apprentice" as involving some sort of servitude and loss of dignity.

These facts are now recognized in the case of the heating contractors' association and its committee on apprentices has gone on record as favoring the term "certified steamfitters' helpers" in place of "apprentices."

As the committee states, the name, apprentice, is not appropriate as a designation, as it signifies a relation, by indenture, to an employer, for a considerable period of time at little or no remuneration, while learning a trade. This idea is obsolete and not at all the aim of the employer in this industry.

The committee also offers some very definite suggestions for attracting and training young men to become steamfitters. In the matter of eligibility, for instance, to the status of a certified steamfitters' helper, the committee would include not only the young man who is already engaged in learning the trade, but also "any boy not less than sixteen years of age, preferably American, who has had a grammar school education, is mechanically inclined and who possesses a reputation for honesty and good deportment and is physically able to undertake the work."

In the matter of wages for such helpers, the opinion is expressed that the minimum wage for beginners should be made sufficiently attractive to induce the right kind of young men to enter this industry. While the necessary period of service is fixed, in a general way, at not less than four years, the point is emphasized, as it should be, that the real requirement should be a standard of practical and technical knowledge of all departments of this trade. Transfers from one shop to another are recommended to enable the helpers to become familiar with the various kinds of work. Another wise provision is that the agreement between the employer and employee may be terminated or suspended for any reason which seems to the local committee justifiable.

"It should be understood," adds the committee, "that no young man shall leave his employer or change employers before his agreement expires, without the sanction of the local committee."

In connection with definite text-book instruction, the committee suggests that as the public schools in most of the large cities are designed and equipped to give to these young men the necessary technical instruction, it should be the purpose of the local committee to arrange with the head of the public school system for such instruction.

One of the most important points cited by the committee for use in driving home to the journeymen the gravity of the situation and to secure their co-operation is the fact that if the present conditions are permitted to continue and no immediate provision is made for the future, the work now being done by journeymen steamfitters is likely to be absorbed by some other class of mechanics and the trade as a whole might face the possibility of being wiped out.

A TIMELY service to the heating industry has been rendered by the board of directors of the Heating and Piping Contractors' National Association in emphasizing once more the distinction between heating and plumbing work. Even as well informed an organization as the National Trade Extension Bureau has fallen into the popular error of considering these two industries one and the same. As the heating contractors' report states, the bureau until recently has used the terms plumbing and heating contractor so indiscriminately as to encourage the plumber into doing heating contracting work and possibly vice versa, neither of which is desirable.

"Inasmuch as this same mistake," continues the report, "has been made by certain manufacturers and jobbers for some time past, in spite of our remonstrances in trade relation circles, it seemed to us that the Trade Extension Bureau was aiding and abetting an already intolerable situation, from the heating contractors' viewpoint. Furthermore, we were not satisfied at all with the decision of the Trade Extension Bureau to call the heating contractor 'heating dealer'."

Equal dissatisfaction, it may be stated in passing, was expressed by the master plumbers at their recent convention over the T. E. B. designation of a master plumber as a "plumbing dealer," and the association went on record as favoring the term "master plumber."

It is to the credit of the Trade Extension Bureau that the situation had only to be called to its attention to bring about the desired changes in policy, with the result that the two organizations are now co-operating in a way that will give the heating industry its due place "in the sun."

# The Rise of Electricity in Home Heating

By O. H. Bathgate

FAR back in the ages, perhaps a thousand centuries or more, primitive man, little more than an animal himself, fought with nature and the savage beasts of his time for a mere existence, the privilege of living.

His first urgent need was for food. Hunger spurred his inventive genius to the creating of crude implements of destruction for the hunt. Then storms of his region, beating upon his unprotected body, compelled the erection of rude shelters and the making of rough clothes, fashioned from the skins of wild animals he had slain.

Protection from the elements must have been as great a problem as any that he faced in those truly strenuous times and while the rough shelters of stones and earth, branches of trees, etc., and the clothes of fur served as a measure of protection, especially to man living in the colder climates, how he must have longed for a more comfortable existence!

His first acquaintance with fire had nothing in it to inspire him nor to cause anything except a feeling of dread. Here was a flaming demon, unloosed by lightning or volcanic eruption that, time after time, destroyed his woodland home, that drove the game from his countryside and left naught but charred and blackened ruins. It was just another enemy to contend with and one whose power compelled a deep respect.

Details of his subsequent actions must ever be a matter of conjecture, a secret hidden by the lapse of time, yet we know that he eventually lost his fear of this new factor in his life and learned to control it.

Back to his tribe he carried his new found treasure and we can imagine the excitement and delight that must have prevailed. Here was a weapon that the fiercest animals of the forest feared—a weapon that would protect the tribe from its most dangerous foe. They slept close by it for protection at first and later for its cheery warmth. After a time they learned to use it in preparing food. This source of heat and light, this protector from savage beasts and cooker of foods soon became the most precious thing primitive man possessed—his greatest ally and friend.

No doubt the tribesmen wondered not a little at the magic sparks which would fly from the pieces of flint as they chipped them to make weapons, until the day when one of the sparks lit in the frayed and splintered wood of the chipping block, smouldered and then burst into flame. Here was their friend again—come out of the stones to light the fire and bring them comfort and protection.

As his weapons became better, man feared the animals less and less. He did not need the fire for protection so much as he needed it for cooking and for comfort. Now there was not so much dread of the long cold winter season. His home might be a cave, a hut or a tent, but whatever it was there was the fire in the center to warm it. However, the smoke from the open fire choked him at times and stung his eyeballs till the tears came. Again necessity and discomfort spurred his ingenuity. He learned that a hole in the top of the hut would let the smoke out. This was the first idea of a chimney. Later within his close winter quarters he felt that the fire in the center of the room took up too much space. He built a pit of mud and stones against the wall and built a fire in it. He used a tube of branches plastered with mud to convey the smoke from the pit directly out through the hole in the roof. This was the first rude fireplace with a chimney, the counterpart in principle of the many fireplaces which have cheered homes ever since.

As our life today becomes more complex, we ask more and more of the men who make it possible to heat our homes. Primitive man had little to worry about after he mastered his greatest problem, *how to make the fire*. He cared little for appearances so long as the fire did his work. He was pleased if he had a chimney to take the smoke out of his hut. He never had to give a thought to the fuel he burned. There was always more in the forest and no bills to pay. What he wanted was H-E-A-T.

Heat is still the first demand and always will be as long as winter comes and men must produce with efficiency. But modern conditions call for more. First we asked for a method of heating that would not mar the appearance of our rooms. Then we asked for heat with greater comfort; now, with our forests devasted, the last word from the coal fields urges us to ask again, and this time for heat with the greatest economy of fuel.

In order that the problem of domestic heating may receive its full share of consideration, attention may be called to the U. S. Government figures on the total coal consumption in the U. S. during the year 1918. This amount was 857,000,000 tons. With 16½% of the total mined early being used for domestic purposes, the consumers expense for this fuel approaches one billion dollars. In addition to this direct-fired fuel cost, the constantly increasing domestic electric heating load is reaching enormous proportions, more especially in those sections of the country where hydraulically generated power rates are low and climatic conditions are comparatively temperate.

A summary of mean monthly atmospheric temperatures of four cities taken during the last fifty years indicates the relative extent so far as districts are concerned, to which consideration should be given to this kind of heating problem.

| | Seattle | San Francisco | Los Angeles | Pittsburgh |
|---|---|---|---|---|
| | Deg. F. | Deg. F. | Deg. F. | Deg. F. |
| January | 40 | 50 | 54 | 31 |
| February | 42 | 51 | 56 | 31 |
| March | 45 | 53 | 57 | 40 |
| April | 50 | 54 | 60 | 51 |
| May | 55 | 55 | 62 | 62 |
| June | 59 | 57 | 65 | 71 |
| July | 64 | 57 | 70 | 75 |
| August | 64 | 58 | 71 | 73 |
| September | 59 | 59 | 69 | 66 |
| October | 52 | 58 | 65 | 55 |
| November | 46 | 56 | 61 | 43 |
| December | 42 | 51 | 55 | 34 |
| Av. | 51 | 55 | 62 | 53 |

From the above table it is reasonable to conclude that the West coast districts are from a climatic standpoint more fortunately located than Pittsburgh or other localities having wide variations in seasonal temperatures. It would seem that where the average monthly temperature difference exceed 25° to 30°, the application of electric heat to the home will be limited to those of large financial means and possibly to some others who may wish to use electricity for auxiliary heating during the early Fall and late Spring.

### The Miracle of Coal

I am going to invite you to accompany me, in imagination, to some bog in Minnesota where year after year the sunshine causes the grasses, mosses, ferns, weeds and trees to grow, and fall into the wet morasses, or bogs, carrying with them the aroma and color of leaf, flower and stalk. Also gums, resins and saps soon to become peat, and at some future time coal.

To me it is a wonderful thought that ages and ages, and yet more ages ago, the very same thing was going on in an orderly manner, and that an all-wise Creator was literally canning sunlight and heat for future use. Those plants contained, just as they do today, fibrous matter like cotton and jute, and associated with them are starch, sugar, resin and oils, colors and perfumes.

They only need the touch of the modern wizard, the chemist, to show us not only the canned sunlight and heat of those far-away days, but also the radiant colors and fragrance of the blossoms. Each of you can recall the modern derivatives from coal, such as tar, lamp black, roofing pitch, moth balls, explosives, perfumes, dyes, creosote, ammonia, medicines, carbolic acid, baking powder, nitrates, sugar; in fact, everything found in plant life, even to the lycopodium, or dust in the stamens and petals of the flowers preserved for our present use, as fuel.—L. W. Millis, *before the Warm Air Study Club of the Security Stove & Mfg. Co., Kansas City, Mo.*

TYPES OF ELECTRIC HEATERS.

Of the more numerous types of electric heaters now installed for home heating purposes, the following may be listed.

Radiant air heaters.
Convection air heaters.
Radiant convection air heaters.
Pipe and pipeless furnace heaters.
Conduction radiator heaters.
Induction type water heaters.

The radiant type air heaters includes the 660-watt Cozy Glow type of heater to that of units as large as 6000 or 8000 watts. Its principle of heating is similar to that of the old type open fire place or more modern radiant fire gas type of heater. The electric heat application of this principle differs very little, if any, from that of the direct fuel fired heater.

The unit type convection air heater is one built along the lines of maximum air circulating principle with provision for the absorption of radiant heat by convection air currents passing over low temperature electric heating elements. Several designs of this type of heater are now being made in the City of Seattle, although I have never found any of these in service elsewhere in the States.

The radiant convection type of air heater is made of electric heating coils, operating at a temperature corresponding to a radiant glow and, in conjunction with this, provision in design allows air circulating current to move upwards past the heating elements, thereby effecting a distribution of a part of the dissipated heat to remote sections of the room.

For electric heating where only localized sections of a home are to be heated, at any one time, the combination radiant-convection air heater has the advantages of all the other types, combined. It is more durable and more endurable than the strictly radiant type. It operates at near maximum efficiency both as relative to heating and the distribution of heat. The nearest approach to this type of heater is manufactured and sold in large quantities in the San Francisco district. A heater of this type is now being developed in the East and will doubtless be on the market within a short period of time.

The electrically-heated pipe and pipeless furnaces as developed, consist of the ordinary fuel fired warm air heating furnace, equipped with low temperature heating elements in space formerly occupied by combustion chamber. With air heating furnaces of this type, built with substantial heat insulated covering, the efficiency factor, the humidity and ventilation of the home and the simplicity of temperature control equipment all tend to make this kind of heating worthy of careful consideration. Where it is desired to have the entire home heated all or most of the time this kind of system has few disadvantages. The absence of any kind of heating apparatus in the rooms is a realization with this indirect convection air heating system.

The direct application of electric heating elements to steam or hot water radiators of the old standard type is used to a limited extent in certain localities but this practice necessitates objectionable control operating features that may more than offset its advantages.

The direct application of electric heat either in the form of a steel clad element or an induction type heater to home heating hot water or steam tanks located in the basement, is a system now in use to some extent and is one not without merit. This kind of system must depend on the usual type of water or steam radiator for a medium of heat distribution in the rooms to be heated.

For control, the simplest kind of thermostatic equipment will function with even greater accuracy and more efficient results than can be obtained with any type of fuel-fire heating boiler.

The thermal storage principle involved and particularly adaptable to this type of heating system is one that the power companies soliciting load have not overlooked and on this account alone, the future for this type of electric house heating looks promising. During off-peak power loads on the power company's lines, clock-operated switches may be used on separate house heating lines which will permit raising the temperature of the water in the boiler to a maximum. This accumulation of thermal energy can be used for room heating when the family arises in the morning and again toward evening when the power load peak has returned.

It is with such possibilities as above mentioned, together with the continuous rising costs of coal and consistent decrease in cost of large blocks of power now being generated or under development in hydraulic systems, that we do not hesitate to predict that in a very few years electric home heating will be more common in large areas of the United States than any other type of heating systems.

Twenty-five millions of the total population of the United States live in climates such as are found in Seattle to San Diego and to Atlanta in the East, most of which country is largely served by water power or that generated from cheap oil. With a climate such as exists in Pennsylvania and New York, the average number of a season's heating hours is about 3,000. In the south and west the average at 900 may be considered unusually large. The relative intensity of heat demand in the two localities is around one to two or in other terms, the electricity required for heating a home during a season, is approximately one to ten for the Pacific Slope and Southern territory in comparison with locations such as Pittsburgh, Pa.

Having recognized the large differences in home heating demands in sections of the country where electricity can compete with other fuels on a heat unit cost basis, it is desirable to point out here the electric heating power possibilities, in those sections in which reliable data has been obtained.

COMPARING ELECTRIC AND FUEL HOME HEATING

In comparing home heating by coal and electricity, we may assume an average practical efficiency obtainable in either instance. If the operating labor factor for firing and handling ashes is entirely ignored, the operating cost for electric heat at one cent per kilowatt hour corresponds to a $16.00 per ton coal rate.

With a 350 B.T.U. gas at $1.25 per 1,000 cu. ft. which corresponds to some city gas rates in the northwest, a two-cent kilowatt hour electric rate is the equivalent for domestic heating.

EFFICIENCY OF HEATING

In considering the application of heat to furnaces, ovens or homes, superficial comparisons are often made without considering relatively, the products to be heated, heating cycle, temperatures and designs of equipment by which the heat is applied. In this respect the value of a comparison of house heating equipments is of as little consequence as one of industrial furnaces that may operate at 1,000 to 5,000° F., where production factors do not permit with celerity, a direct comparison.

In considering electric home heating from a purely efficiency standpoint, the type of heater, the kind of heating desired and the care exercised in operating the equipment are factors, vital to its success.

As an example of efficient electric home heating, I would recommend, from my experience of the art and knowledge based on actual operating data collected in the San Francisco Bay district, a combination radiant-convection type room air heater for each section of the building to be heated. The back of these heating units would be well thermally insulated so as to reduce the radiant heat into the walls to a minimum. The front and vertical plane of the heater would permit at least 75 per cent. use of the convection principle of heat transfer to the room.

Manual or combination of manual—thermostatic control for each heater are practical methods in use in a large number of homes.

By operating a unit type heater system of this kind only during such times as the rooms are occupied, the power heating cost will be as low as is practical to obtain. The discomfort of intermittent room heating as thus recommended on account of efficiency, will with a little psychological cultivation, becomes almost negligible.

POSSIBILITIES OF POWER FOR HOME HEATING—ELECTRICALLY

In the eleven western states there is a possibility of developing 42,500,000 horsepower. Approximately 5 per cent. of this total available has been developed and it has been estimated that another 2,500,000 horsepower will be put in service during the next ten years. It is reasonable to suppose, since this section of the country never will compare industrially with the East where raw materials are found in greater quantity—that large amounts of these blocks of power will be used for heating purposes and particularly for home heating where favorable conditions exist.

Most all of the Pacific Coast power companies are soliciting home heating load and have prepared or are preparing to fix their rates to attract the consumer.

The rates at present vary widely in dif-

ferent localities, the minimum for any large municipality being around one-half cent per kilowatt hour.

EXAMPLES OF HOME HEATING—ELECTRICALLY

During the coldest month of the winter 1921-22 in the San Francisco District, the following data were obtained. The kilowatt hour figures include power used for heating water for domestic service and electric air heaters for the rooms.

A 12-room home used 1760 K. W. H.
A 10-room home used 1450 K. W. H.
A 6-room home used 1110 K. W. H.
A 5-room home used 700 K. W. H.
A 12-room apartment used 5000 K. W. H.
A 10-room home in Los Angeles used 1700 K. W. H.
A 12-room apartment (2 and 3 rooms each apartment) located in Portland—monthly electrical bills for lighting, water heating, range and room heating are $5.09 min. and $12.69 max.

In Tacoma, Washington—electric home heating has become so popular, that a new home is not considered modern unless it is provided with full electrical equipment, including heat. The average home uses, each year, about $80.00 worth of heat, $45.00 worth of cooking and lighting current and $30.00 for water heating.

The house heating contracts in Tacoma for several years back are as follows—1919-701; 1920-1356; 1921-2229. The residence light contracts during these same years were 1919-20859; 1920-22168; 1921-23688. In other words, the contracts for home heating during these 3 years were more than 60% of the additional contracts for home lighting.

For air heaters and ranges, the Tacoma contracts number 12757 against 23688 for residence lighting.

Present range, water heater and air heaters connected 30,000 K. W.

The homes heated electrically in the City of Seattle were in 1922-1978, this represented a phenomenal increase in the comparatively short period of its existence.

Some very extensive reports have been compiled on the subject of home heating electrically, but these now being several years old are not based on modern practice and have just as little bearing on present day efficient practice as does the old reciprocating steam engine have to the modern low-pressure turbine.

Power companies located in sections of the country where electric home heating is and should be favorably considered are promoting installations in every way possible.

The general tendency of power rates is downward with the result of growth of water and air heating loads, seeming to indicate that this class of business will increase very rapidly in the next few years.

The canvass of households by one of the California power companies indicates that where one person is interested in an electric range, three are interested in obtaining at least a moderate amount of electric heat for rooms. Otherwise stated, the demand for room heaters will likely be very much larger than for ranges or water heaters, although in many instances, all three of these utensils will be installed.

The kilowatt hours sold in Seattle for domestic heat was in 1916-526000 and in 1921-3812000, or an increase of 650% in five years.

One more thought within the scope of this paper that has not as yet been referred to, is in connection with electric heat in the office, in large apartment buildings, in hotels, churches, theatres, studios, schools and other types of public buildings. No less than ten architects and heating engineers in Los Angeles and San Francisco, have expressed the opinion to me that where power rates were reasonably low, they were willing and would have little difficulty in incorporating modern electric heating equipment in designs of many different classes of buildings. They are already working out extensive plans along these lines and as a result, electric air heaters are now being sold extensively in lots of a few to several hundred per building for this class of service.

In considering the information in this report, it must be remembered that the facts are of practical origin based on electric home heating and its application in temperate climate where coal is high in price and hydraulic-electric power is low in price and of almost unlimited possibilities for extending the development.

# Apprenticeship Training in the Building Crafts

The apprenticeship problem will largely solve itself if the workers are made to feel that their part is recognized as a real factor in the success of any enterprise, according to D. Knickerbacker Boyd, in a recent address at the fifty-sixth annual convention of the American Institute of Architects in Washington, D. C.

Regardless of the arguments to the effect that the fault lies with those who, it is claimed, are trying to restrict the number of apprentices, or with the employers who, it is also claimed, are unwilling to assume the responsibility of training young men, Mr. Boyd asserted the real difficulty seems to be that "boys do not exist in sufficient numbers who want to learn the crafts and trades." He urges, therefore, that a solution will largely be made if young men can be interested in the work.

"The young man of today," he said, "does not seem to want to enter what he considers the 'laboring field.' So why go into protracted academic discussions as to who is responsible for the lack of numbers? We need to discover the cause for the lack of interest on the part of the boys.

"We must inculcate the idea in the young men of America that the crafts do offer a future for them, and we must stimulate in their minds a desire to achieve something dignified and definite with their hands. The craving of every human being to create and accomplish can be satisfied through craftsmanship properly appreciated.

"The present difficulty does not rest so much with the boys, it seems to me, as it does with their parents, and with most of the educational systems of the country. Traced back into the homes of the children, I really believe that the fault lies more with the mothers, sisters and sweethearts of the young men and boys, than it does with almost anyone else. These dear ladies, most of them, do not want to see their boys, brothers or 'boy friends' dressed in overalls or the clothes of the workmen, and littered with mortar, plaster, sawdust, metal filings or paint. They do not seem to like that and they therefore use their persuasion on their relatives and friends to keep them from training for or engaging in this sort of work.

"After all the greatest discourager of the boy who might want to become an apprentice in the building trade can be, and most frequently has been in recent years, the father who is working in the trades.

"The journeyman of the present generation now working on the buildings we design realizes that he has lost much time in the eastern and other sections of the country subject to cold climates, through seasonal losses of occupation. He has, in normal times, been subject to the intermittency of employment and he has been working at what is almost always rated a hazardous occupation. These men can be the greatest enemies of the building crafts today. I think the fault lies partly with the construction groups, the public and with us as individual architects."

### Survey of Seasonal Operation in Construction Industries.

Whether or not the general impression is true that seasonal building has resulted more from custom than because of weather conditions, should be disclosed through the activities of the committee appointed by Secretary of Commerce Herbert Hoover, as chairman of the President's Conference on Unemployment. That committee, which is headed by Ernest T. Trigg, a manufacturer of Philadelphia, Pa., is undertaking a thorough survey to determine if construction work may not be carried on throughout the year. This would eliminate the great waste which now results from several months of idleness annually on the part of industry, and building workers. Members of the committee believe elimination of the seasonal factor would bring about lower relative costs in dwellings and other buildings.

# The Usefulness of the Kata-Thermometer in Determining Healthful Air Conditions

## Results of New Studies with This Instrument, Bearing on Body Heat and Efficiency, Showing the Numerous Fields in Which the Kata-Thermometer Will Prove of Value.

Those interested in learning of the usefulness of the kata-thermometer in determining healthful air conditions will find a world of information and test data in a report recently issued by the Medical Research Council (London), under the title of "The Kata-Thermometer in Studies of Body Heat and Efficiency."

As the preface states, the volume contains observations in which the kata-thermometer has played a chief part and which indicate the numerous fields in which the introduction of the kata-thermometer has proved of value.

How useful the kata-thermometer may be in this connection will be gathered from the statement that "it is well-known that wet-bulb temperatures in factories and mines are much more important than dry-bulb temperatures in determining the atmospheric conditions suitable for workers; vapor pressure is much more important than the relative humidity; and the velocity of movement of the air is most important of all, for on this chiefly depends cooling by convection and evaporation. The ordinary thermometer indicates the average effect of the temperature of the air and walls of an enclosure on itself; it does not show the cooling and evaporating power of the environment on the skin and respiratory membrane. It is a static instrument, while the body is dynamic, producing heat which much be lost at an equal rate to keep the body temperature normal. To measure these cooling and evaporative powers, the kata-thermometer was introduced and it is because of these properties that the kata-thermometer has been employed in the investigations herein described. Readings of the kata-thermometer have been taken in laboratories and factories while subjects were carrying out muscular work, in order to determine whether the atmospheric conditions were suitable to remove the heat produced by the bodies of the workers, so that the workers could be kept comfortable and efficient."

The evidence presented in the report, it is stated, proves:

1. That in the judgment of all observers in all parts of the world, atmospheric conditions classified by one of us on the objective basis of kata-thermometric readings as unsatisfactory, are, when tested by the subjective sensations of the observer, hard to endure.

2. That in every case in which the subjective sensations were controllable by an objective test of industrial output, necessarily a much smaller number of instances than covered by (1), the test gave proof of diminished efficiency.

3. That in a sensible, often a large, proportion of factory departments in certain industries known to be generally subject to high rates of mortality and morbidity from all or from certain causes, atmospheric conditions judged by kata-thermometric standards are unsatisfactory. Thus in the boot and shoe, printing, pottery, and cotton industries the mortality increases as the cooling power lessens.

### How to Apply Kata-Thermometer Readings.

As is well-known, the kata-thermometer is an instrument which was designed by Leonard Hill to measure the rate of heat loss of a surface at approximately body temperature (97.7° F.) with variable atmospheric conditions. The method is based upon the rate of cooling of a hot body. The instrument is essentially an alcoholic thermometer, with a range from 95° to 100°.

The kata-thermometer may be used either to estimate the cooling power of the air or as an anemometer to indicate the velocity of air currents. The observations in each case are taken in the same way. The bulb is first placed in hot water until the meniscus indicates 100°. It is then taken out, quickly dried and placed in a support.

The column of alcohol immediately begins to fall and the time which it takes to drop from the 100° mark to the 95° mark at the bottom is noted. This operation should be repeated several times for accurate results. The average time is then figured and expressed in seconds.

On the back of each instrument is a factor. This factor, divided by the average time in seconds, as already mentioned, gives the rate of heat loss. This is known as the "cooling power." If it is only desired to use the instrument for estimating the cooling power of the air, this is all that is necessary.

A "wet-kata" consists of an ordinary kata-thermometer with the bulb covered with a moistened open-mesh silk or cotton glove. The instrument then, in addition to losing heat by radiation and convection, also loses heat by evaporation, the amount of this loss depending upon the humidity of the air.

4. That in the exact experiments of particular trained observers the general statistical inferences of (1) and (3) are confirmed.

5. That the *tempo* of the fundamental metabolic processes of the body responds rapidly and considerably to changes of atmospheric condition, and responds in the sense predicted by the general reasoning based upon kata-thermometric measurements set out in the former reports.

It is submitted that the five preceding propositions are definitely established by the evidence contained in this report and its forerunners.

What is not proved is that conditions condemned by these results do directly increase either morbidity or mortality, that is to say, it has not been shown that in factories where atmospheric conditions, determined by kata-thermometric standards, are bad the incidence of disease and death is greater than in the average of factories of that type. Neither has it been shown that the very wide deviations between known rates of mortality in industries are correlative to divergences in atmospheric conditions.

In Part I, written by Miss D. Hargood-Ash and Dr. Leonard Hill, the more recent researches regarding the kata-thermometer as a physical instrument are recorded, and the information required by those who use the kata-thermometer put in an available form. In addition to the ordinary kata-thermometer, the electric and the recording kata-thermometers are also dealt with. Part II is devoted to a comparison of kata-thermometer readings in temperate, alpine and subtropical climates, written by Dr. Leonard Hill. Part III takes up the use of the kata-thermometer in industry. This section is written by H. M. Vernon, M. D., and gives the data obtained in the workshops of various industries, including the boot and shoe industry, printing industry, pottery industry, and in workshops with abnormal atmospheric conditions, such as those connected with the textile industries, especially cotton and linen. A modern laundry was also investigated.

Part IV contains a kata-thermometric comparison of methods of heating and ventilation, the heating section being written by T. Bedford and the ventilating section by T. Bedford and T. C. Angus. One of the interesting results reported by Mr. Angus indicates the effectiveness of the jet tube system for improving the physical condition of the air in hot rooms, in comparison with

the effectiveness of the plenum trunk system.

In another section of Part IV, Dr. Hill discusses the experiments carried out by Messrs. Drinker and Thomson with a White portable humidifier in which a study was made of the effect of increasing or lessening the humidity of the air in a room (See THE HEATING AND VENTILATING MAGAZINE for January, 1922).

An important section of Part IV is devoted to the extensive ventilation tests conducted by T. C. Angus on board a large Atlantic liner.

Part V is devoted to the index of comfort at high atmospheric temperatures, also by H. M. Vernon, M. D. In this section Dr. Vernon gives the results of tests similar to those conducted at the Research Laboratory of the American Society of Heating and Ventilating Engineers. The endurable mean limit of wet-bulb air temperature, as found by Dr. Vernon, was 85.8° F. with no clothing, 80.9° with light clothing, and 80.1° with moderate clothing. One of his conclusions is that there is no single index of comfort in atmospheric conditions, but it is concluded that the wet-bulb temperature is a much better index of comfort than the dew-point. Still some allowance must be made for humidity, especially if the air is over 70 per cent saturated with moisture. Dry kata-thermometer readings are very important and if it is known that the air temperature is a suitable one, they form a fair index of comfort for ordinary conditions. Their greatest value lies in the fact that the air velocity can be calculated from them."

Part VI is an extended discussion by Dr. Leonard Hill and J. Argyll Campbell of observations on metabolism during rest and work, with special reference to atmospheric cooling power.

In Appendix I, E. H. J. Shuster describes a new type of recording kata-thermometer. May Smith, in Appendix II, tells of some interesting alterations made in a laundry to improve the atmospheric conditions. Finally, in Appendix III, T. C. Angus discusses the effect of moisture upon the cooling power of air as measured by the dry-bulb kata-thermometer.

The report is a volume of 196 pages, 6 x 9¾ in. and bears evidence throughout of the painstaking care which the tests were made and the data compiled. For instance, in Mr. Bedford's account of the study of different methods of heating, the observations, to be sure, were confined to boot and shoe factories, but the study covered buildings equipped with steam or water heating pipes at floor level, those overhead from 8 to 12 ft. above the floor level, and those equipped with plenum systems.

Lower cooling powers were found where heating was by overhead pipes than where other methods of heating were in use. In most cases the cooling power was lower at head level than at floor level. Although there is a greater difference between the temperatures at head level and floor level in factories with overhead heating, cooling powers do not differ to the same extent. This is attributed to different rates of air movement.

In the comparison of ventilation methods, by T. Bedford and T. C. Angus, the investigation included factories equipped with:

1. Natural ventilation by means of open windows.
2. Natural ventilation by means of roof cowls, louvres and skylight windows.
3. Plenum (propulsion) systems.
4. Combined plenum and extraction systems.
5. Extraction systems.

The conclusion was reached that for a given fan output a "directional" system (using exhaust fans only, with the air flow in the direction of the fans) yielded higher air velocities and consequently better cooling powers than were obtained with a system of combined plenum and extraction ventilation. This was attributed to the absence of eddy currents in "directional" ventilation.

Included in the same section are the results of experiments by Mr. Angus indicating the effectiveness of the jet tube system for improving the physical condition of the air in hot rooms in comparison with the plenum trunk system.

## An Instrument Which Locates Leaks in Underground Pipe Lines

A device known as the geophone, which was developed during the war for detecting vibrations of the earth, due to tunnelling, etc., has been used with remarkable success in locating leaks in underground pipe lines. The instrument and some of its applications are described in Technical Paper 277, of the Bureau of Mines.

In speaking of three instances in which the geophone was used for locating leaks, a correspondent of *Mechanical Engineering* for July, 1923, states:

The first leak was in the return of the heating system and was located accurately under 4 ft. of cover.

The second leak was in a domestic hot-water pipe encased in a concrete duct packed with mineral wool and under 4 ft. of cover. The line extended from a tunnel to a building 250 ft. away. The evidence of the leak appeared as warm water from the underdrain into the tunnel. The leak was located 200 ft. from the tunnel and proved to be a pit hole in the pipe about 3/16 in. in diameter.

The third case was in a 5-in. steam line carrying 10 lbs. steam pressure. The line is encased in a concrete duct. The leak was located at a point which proved to be 9½ ft. underground.

In all these cases the leaks were plainly audible for 10 ft. or more on each side of the point at which it was finally decided that the disturbance was loudest. In each case the first excavation put down centered on the leak.

The geophone, as described in a recent research narrative of the Engineering Foundation, is a sound-ranging instrument invented by the French during the war. The form of the instrument was developed by U. S. Army engineers and the U. S. Bureau of Standards.

The instrument, in principle, is a seismograph and is entirely mechanical in its action. It consists of a flat iron ring about 3½ in. in diameter and ½ in. in thickness, in the center of which is suspended a lead weight fastened with a single bolt through two metal discs, or diaphragms. One of these diaphragms covers the top, the other the bottom of the iron ring. There are two brass cap pieces, the top one having an opening in the center to which is fastened a rubber tube leading to a stethoscopic earpiece.

If the instrument is placed firmly upon the ground and there is any pounding or digging in the vicinity, the case of the instrument will vibrate with the earth. The lead weight, because of its mass, will, however, remain comparatively motionless, since it is suspended between the elastic diaphragms. There is thus produced a relative motion between the diaphragms and the case. This motion alternately compresses and rarefies the air in the spaces between the cap pieces and the diaphragms. The air waves thus set up within the instrument are then transmitted to the observer's ears by means of the rubber tubing and the earpieces. The small enclosed air-space in the bottom of the instrument, between case and diaphragm, serves to dampen the vibrations of the diaphragms. It is customary to use the geophones in pairs, connecting one instrument to each ear. The direction of a sound from an observer can in this way be determined with considerable accuracy on the binaural principle of direction determination.

## J. L. Hecht on Opportunities of the Engineer in the Chicago District.

A notable address was delivered by President J. L. Hecht at the annual meeting of the Western Society of Engineers on "Opportunities and Responsibilities of the Engineer in the Chicago District." Mr. Hecht is a former president of the National District Heating Association.

"We think of Chicago today," he said, "in terms of 210 sq. miles with 3,000,000 people and with a strategic geographic position. The Chicago of tomorrow must not be thought of in terms of that little area, but rather with the present Chicago as a hub and stretching out many miles beyond present boundary lines.

"This Chicago," he added, "may well be the metropolis of the wealthiest empire; the wonder of the world and the fastest-growing large city.

"Great are the problems of rebuilding and readjustment," declared Mr. Hecht, "which must follow along with such swift development of not only a now functioning large city, but the development of a great and connected residential and manufacturing district, which within itself may be composed of many separately organized communities; organized for government, *but whose public works and services must all be part of a great general plan.* So great are these problems going to be that their solution cannot and dare not be left to the politician, the business man or the lawyer."

# Comparative Heat Losses from Saturated and Superheated Steam Lines

One of the interesting reports submitted at the recent convention of the National District Heating Association by the Station Operating Committee, (R. D. DeWolf, of Rochester, N. Y. chairman) gave the results of tests made by the Rochester Gas & Electric Corporation to determine the relative effects of saturated and superheated steam on the heat insulation of steam mains.

A 10-in. extra-heavy high-pressure feeder line was chosen for the purpose of the test and it was so connected to the power station that either saturated or superheated steam could be supplied. The section tested was 1250 ft. long of continuously-welded pipe, with two 90-degree bends of 10 ft. radius and two deflections of about 45-degrees, also with 10-ft. radius bends. The line was of overhead construction, supported on towers or hung from brackets, and was insulated by 1½ in. of 85% magnesia next to the pipe, then 2 in. of hair felt. It was then made weather-proof with a covering of rubberoid roofing material.

The line was graded to drain with the flow of steam for about 1100 ft., at which point a drip pocket, with trap connection, was welded into the line. Beyond this point the line ran up a hill at an angle of about 45 degrees for a distance of about 150 ft.

At each end of the section to be tested, instruments were installed to read the pressure, temperature and flow of steam. A condensation meter was also installed for measuring the discharge from the steam trap connected to the drip pocket. Before tests Nos. 2, 3 and 4 were made, a surface condenser was installed between the trap and meter to condense all vapor flashing off from the hot condensate, thereby enabling the condensation meter to measure all condensate removed.

### TEST NO. 1.

Test No. 1 was made during July, 1922, at the time the line was completed. After the line had been under pressure for one week without load, the condensation meter on the drip pocket was set at zero and readings taken for a period of five days. For this test no surface condenser was installed at the trap discharge so that the amount of condensate, which flashed into steam and thus escaped the meter had to be calculated and added to the meter reading. The valves at the top of the hill at the far end of the line were locked closed during this period. This insured all condensation being returned to the drip pocket and thence to the meter.

For this test superheated steam was supplied at the station end but as there was no flow it probably dropped to the saturation temperature within a short distance. No measurements were taken to determine how rapidly or at what point this superheat was dissipated so that for lack of more definite information the average line temperature was assumed to be the average of the initial and final temperatures.

For this test it was assumed the number of pounds of steam supplied was equal to the number of pounds of condensate removed. The steam was supplied at an initial pressure and temperature of 180 lbs. gage and 439° F., therefore had 1234.5 B. T. U. per pound. The condensate collected in the drip pocket at 380°, therefore had 352.7 B. T. U. per pound. The difference or 881.8 multiplied by 315, the pounds of condensate removed per hour, equals the total heat units lost per hour. This divided by the external surface of the steel pipe times the difference in temperature between the average steam and atmosphere equals, for this test, 0.233 B. T. U. per hour per square foot per degree difference of temperature between steam and atmosphere.

### TEST NO. 2.

Test No. 2 was made May 5 to May 7, 1923. The line had been operated continuously for several months under superheat conditions but on May 4 at 12:00 o'clock noon it was changed to saturated steam and 24 hours allowed for the heat insulation to adjust itself to the lower temperature. At 12:00 o'clock noon on May 5 the valves at the far end of the line were again closed and kept closed until the following Monday morning at 7:00 o'clock, May 7, a period of 43 hours.

This test was conducted in the same manner as Test No. 1 with the exception that the initial steam was dry saturated and a surface condenser had been installed between trap and condensation meter as previously mentioned.

The result of thus using saturated steam gives a loss of 0.219 B. T. U. per hour per square foot per degree difference of temperature, which practically agrees with Test No. 1 run nine months previously.

### TESTS 3 AND 4.

Tests No. 3 and 4 were run with superheated steam throughout the line under low load conditions. The method used was to determine the heat content per pound of steam at the beginning and end of the line by means of pressure and temperature measurements. The difference would, therefore, represent the heat loss per pound of steam flow.

The reliability of this test depends chiefly upon the accuracy of the temperature measurements. The thermometers used were of the engraved glass, mercury-filled type, with metal guard and were of the same type and length. The wells used were 4½ in. long, inserted in the top wall of the pipe and filled with cylinder oil. After the thermometers were installed in the wells, a piece of hair felt, 2 in. thick and 2 ft. square, was bound around the insulated pipe with a small hole through it to allow the steam of the thermometer to protrude so it could be read. Every effort was made to make the thermometer installations similar so that any errors would tend to be equal and in the same direction. The thermometers themselves after the test were both inserted into an oil bath at the same time and checked for accuracy at the temperatures met during the test.

The pressures were read on standard test gages with 10-in. dials, graduated to 1-lb. divisions and calibrated before the test.

During these two tests readings were taken at one-minute intervals of the steam pressures, temperatures and flow meters and averaged. The calculated pressure drop at the steam velocities used in these two tests was about ½ lb. The steam flow readings at the two ends of the line checked within 3% or less. This leaves the burden of responsibility up to the temperature measurements, and these we believe to be fairly accurate, for the reason that during test No. 2

| Test No. | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Date | July 1922 | 5/5/23 to 5/7/23 | 5-4-23 | 5-11-23 |
| Duration of Test | 5 days | 43 hrs. | 30 min. | 30 min. |
| Quality | Final | Initial Sata'ted | Superheated Sat'ated | Superh'd | Superh'd |
| Avg. initial pressure—lbs. gage | 180 | 195 | 194 | 191.4 |
| Avg. initial temp. of steam, deg. F. | 439 | 386 | 488 | 463.7 |
| Avg. final pressure (1,250 ft. distant), lbs. | 180 | 195 | 193 | 190.5 |
| Avg. final temp. of steam, deg. F. | 380 | 386 | 463 | 441.3 |
| Avg. line temp., deg. F. | 409.5 | 386 | 475.5 | 452.5 |
| Avg. outside temp., deg. F. | 70 | 55 | 57 | 58 |
| Condensate removed per hr., lbs. | 315 | 303.5 | | |
| Steam flow per hr., lbs. | 315 | 303.5 | 12,550 | 18,058 |
| Temp. condensate before removed, deg. F. | 380 | 386 | | |
| B. T. U. in 1 lb. initial steam | 1234.5 | 1198.8 | 1259.4 | 1246.9 |
| B. T. U. in 1 lb. final steam | | | 1246.2 | 1234.8 |
| B. T. U. in each lb. condensate | 352.7 | 359.2 | | |
| B. T. U. lost each lb. final steam | | 13.2 | 12.1 | |
| B. T. U. lost each lb. condensate | 881.8 | 839.6 | | |
| B. T. U. lost per hr. sq. ft. per degree difference in temp. | 0.233 | 0.219 | 0.113 | 0.157 |
| Average | | 0.226 | | .0135 |

on May 7 with saturated steam, the temperatures read, checked correctly with the temperatures corresponding to the pressures read for saturated steam.

Test No. 3 shows loss of 0.113 B. T. U. per hour. per square foot per degree difference, while test No. 4 shows loss of 0.157. We are not able to account for this wide variation in results unless it be that Test No. 3 was made after the line had been under this same temperature for several months, while previous to starting Test No. 4, the line had been at superheat temperature for only twenty-four hours, it having been operated at saturated steam temperature from May 4 to May 10. During the 24-hour period, elapsing from the time superheated steam was turned on the line, the temperature of the pipe and the surrounding insulation was being greatly increased and heat was being stored in the pipe and its surrounding insulation. It is quite possible that this heat-storing process was still in operation at the time the test was made and heat energy was, therefore, being extracted from the steam at a greater rate than would be the case when the pipe and insulating material had been fully heat saturated, so that the B. T. U. per hour per degree difference in temperature was higher than it would be if this heat storage process had been completed prior to the test.

MATERIAL SAVINGS IN HEAT LOSS WITH SUPERHEATED STEAM.

These results indicate a very material saving in heat loss in the distribution system, provided the steam is superheated before being delivered to the distribution system. The B. T. U. loss per hour per square feet per degree difference in temperature with superheated steam is only about 60% of the loss for saturated steam. In addition to this there is a further loss, in the case of saturated steam, due to the fact that the water of condensation, which collects in the line, is trapped out and drawn away. In the case of Tests No. 1 and 2, this amounts to over 300 lbs. per hour. Even if there were no difference in the heat transmission coefficient between superheated steam and saturated steam, we would still save 300 lbs. of feed water per hour in the plant, if we supply the heat loss by radiation by means of superheated rather than by means of latent heat of vaporization.

Several factors may account for the difference in the heat coefficient between saturated and superheated steam. We know that the coefficient of heat transmission for superheated steam is lower than for saturated steam. In addition to this and probably of greater importance is the fact that with superheated steam the inner surface of the pipe line is in all probability dry and the rate of transmission of heat from the core of steam inside the pipe to the inner surface of the pipe itself is much lower when that inner surface is dry than when it is wet.

# Important Actions Taken at Annual Convention of Master Plumbers' Association.

Action was taken on two important matters at the recent forty-first annual convention of the National Association of Master Plumbers in Atlantic City. One was in connection with the apprenticeship problem and the other in connection with the higher education of the "plumbing engineer."

The apprenticeship plan, as finally endorsed provided:

1. That a man be employed as educational director, at a salary included in the proposed budget, to devote his time to promoting training for the industry.
2. That the national association advocate training for the plumbing trade in part-time and evening vocational schools.
3. That a standard course of study for these schools be adopted only after the Minneapolis course has been tried out and reported upon. It is suggested that the Committee be kept in mind when the standard course is formulated. The outline of the standard course should be published in the T. E. B. Bulletin, so that suggestions and criticisms of the members of the trade can be secured. It was recommended that the necessary instruction on gas should be inserted in the standardized course.
4. That instructors in plumbing be sent to some central training point for specialized teacher training, their expenses to be paid by the local associations.
5. That a campaign of publicity be carried on by the educational director.

The estimated cost for the first year comprises a budget of $12,000, which was approved, and which is divided: Salary of educational director, $4,000; traveling expenses, $1,500; rent of office and clerical help, $2,500; printing, $2,000; miscellaneous items, $2,000.

E. L. Bowman will probably be the educational director, and he will take up his duties at the headquarters of the Trade Extension Bureau, Evansville, Ind., about the middle of August.

The movement to provide opportunities for the higher education of the master plumber was warmly advocated in a presentation of the subject by Frank J. Fee, of New York. Mr. Fee made an impressive plea for the plan. While the project was being discussed Mrs. E. D. Hornbrook, on behalf of the National Woman's Auxiliary of the association, pledged $1,000 for a scholarship such as that advocated by Mr. Fee. This helped materially to turn the tide of sentiment and the convention voted to instruct the incoming president to appoint a committee to put the scholarship plan "in effect."

BOILER AND RADIATOR MANUFACTURERS OPERATING AT CAPACITY

In one session which was devoted, in part, to talks by manufacturers, P. G. Seward, representing the Richmond Radiator Company, in speaking of trade conditions, announced that the volume of business is tremendous and is increasing. The capacity of boiler and radiator manufacturers was tested to the limit during the last six months. Usually the first half of the year is light and the last half is heavy. That is to say, twice as much heating equipment is shipped during the second half as during the first half of each year.

"If this rule holds good," said Mr. Seward, "we shall be swamped during the last six months of 1923. We are working to stabilize and level off the peaks of business, and in so doing we hope to build up a steady pull throughout the year."

The new officers of the association are: President, Samuel F. Wilson, Newark, N. J.; vice-president, John J. Vogelpohl, Milwaukee, Wis.; treasurer, Richard J. Welch, Lowell, Mass. (re-elected); secretary, James F. Hanley, Newark, N. J.

HEATING EXHIBITS AT THE MASTER PLUMBERS' CONVENTION.

Manufacturers of heating apparatus who had notable exhibits at the recent Atlantic City convention of the National Association of Master Plumbers included the following:

RELIANCE GAUGE COLUMN CO., Cleveland, O., exhibiting, in operation, a Reliance electric pressureless low-water alarm for heating plants.

PIERCE, BUTLER & PIERCE MFG. CORPORATION, New York, with an imported set-up, made of glass, demonstrating the operation of a Pierce Pebco round boiler.

PENN ENGINEERING CO., Reading, Pa., displaying the Penn portable vice post and pipe bender.

LEBANON MACHINE CO., Lebanon, N. H., with an exhibit of a belt-driven Lebanon vacuum pump in operation.

THERMAL APPLIANCE CO., New York, with various types of the Taco water heaters for installation in connection with heating boilers.

EXCELSO SPECIALTY WORKS, Buffalo, N. Y., showing the various types of Excelso water heaters, including the new double-coil type and the Excelso fire-pot generator.

D. & T. MFG. CO., St. Louis, Mo., which handed out copies of its revised and enlarged edition of "Progress in Hot Water Heating," which contained much general information, as well as data, on the D. & T. tank-in-basement water heating system.

UNITED STATES RADIATOR CORPORATION, Detroit, Mich.

TOLEDO PIPE THREADING MACHINE CO., Toledo, O., which featured its Toledo power drive threading machine, of the portable type.

ROBBINS, GAMWELL & CO., Pittsfield, Mass., showing the Rocago portable electric pipe machine.

# Correspondence

## When Hot Water Does Not Follow the Arrows

EDITOR HEATING AND VENTILATING MAGAZINE:

I would appreciate your advice regarding a 15-year-old domestic hot water service system as shown in the enclosed sketches. I give the heater plenty of attention until late in the night and the water then becomes very hot, but after one hour of use in the morning, it starts to cool (particularly on Sundays), and in another hour or two it is cold.

Sometimes the water alternates hot and cold; again, whenever I shut down for repairs, or a breathing spell, and allow the water to almost steam, the first water drawn at taps is brick red. I have even had to adjust the cold water pressure regulator to 43 lbs. so as to get water to the upper apartments.

The strangest thing of all happened when I shut down to put in the pipe connection D, shown dotted in the sketch. This work did not better matters and soon after starting up, I noticed when feeling of the pipes, that the water circulating between tank and heater was reversed from its usual order. I then knocked on pipe A and opened valve C for a time to sewer, and in a brief time the circulation established itself in the right direction.

Further changes have been proposed, such as shown at F and with cold water connection at E, but the best idea seems to be pipe coils installed in the heating boiler. These have given results since recently installed in a duplicate apartment house nearly under the same management, and where identical troubles were formerly experienced.

The service is certainly inadequate at present in the first mentioned apartment house, yet for many years back it was satisfactory in every respect in both houses.

New York City SUPERINTENDENT

Just as one could with the tip of the little finger move the Mauretania a preceptible distance barring winds and tides, so the movement of water when first heated is affected by factors of seemingly small importance. For example, in starting up the system when full of cold water, there is at first no difference in weight or head between the vertical water columns in pipes connecting tank and heater, and so in the absence of a check valve, there is no more reason why the water should go in one direction than in the other.

### WHY THE HOT WATER GOES IN THE REVERSE DIRECTION

Now with rust collected in pipe A (Fig. 1), and with pipe B connected to the heater at grate level where the first combustion takes place in lighting the fire, the heated water might expand in the reverse direction, and rising in B, be replaced by cold water coming down within this same pipe. Once this condition is established there is a tendency of the colder and heavier water in A to force its way downward through the resisting rust, pushing the warmer and lighter water upward in B, a condition which could not arise if pipe B were run horizontally, as shown dotted, as the water would have to expand the entire horizontal distance before rising up and creating a difference in head to cause circulation.

Eventually, and as the fire gets brisker, the water may heat quicker at the top of the heater, causing the circulation to reverse again—this time in the right direction, or else as the water in the tank becomes heated and rises to the top of the tank, pipe A (being connected at the middle height of the tank) will no longer be able to receive the colder water from the tank, so that the circulation should then right itself. Doubtless, something like this is what actually took place, or possibly the correspondent in knocking on the pipe and then opening valve C, removed the rust by drawing off with the water, causing cold water from the city connection to enter the tank and pipe B. This would leave the heavier water in B, thus starting the circulation downward in same and up in A.

### SUGGESTIONS PERTAINING TO PROPOSED CHANGES

Referring to the sketch, the high points or pockets can do no harm, the dotted pipe D can do no good, in fact it is a useless expense. Connection at E would aid the circulation whenever water was drawn at taps, but would also cause the heater castings to cool too suddenly, and together with pipe F would cause water to be drawn at taps before being fully heated. This is all very well with an instantaeous heater, but it is not the practice to install tank heaters of size sufficient to heat water at the maximum demand rate, but rather to heat it slowly while storing for peak usage. Connection F would be objectionable for like reasons.

Circulation in B will increase the return circulation in G if the latter pipe is connected at E. This gives more motive head for the return circulation, though the main thing to keep in mind is the connecting of the pipes so as to establish circulation in the right direction, for examply, not by a tee as at O, but by a Y. However, it would be proper to use a tee if placed at E.

The cold water supply should also be connected so as to aid circulation, that is, in the end of the tank at H, otherwise alternate cold and hot water is liable to be drawn at taps. Return circulating pipes without checks would also cause this condition.

No further adjustment for increased pressure should be made at the reducing valve, as the heater will only stand 50 lbs., and with rust cleaned out of the pipes, hot water should reach the topmost apartments, the roof tank receiving cold water and storing it when the city pressure is

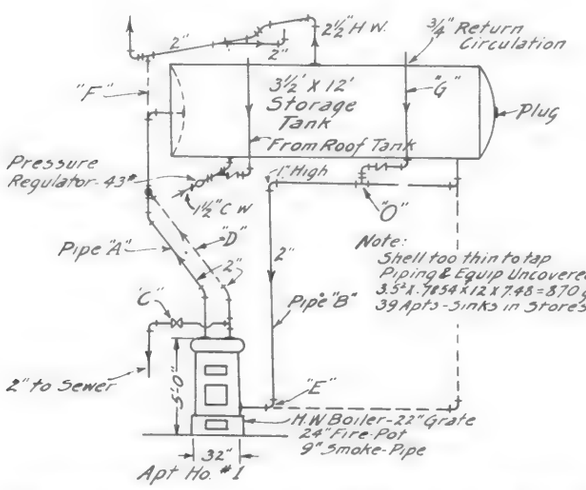



**Fig. 1—Piping Arrangement Which Caused Reversed Flow of Water.**

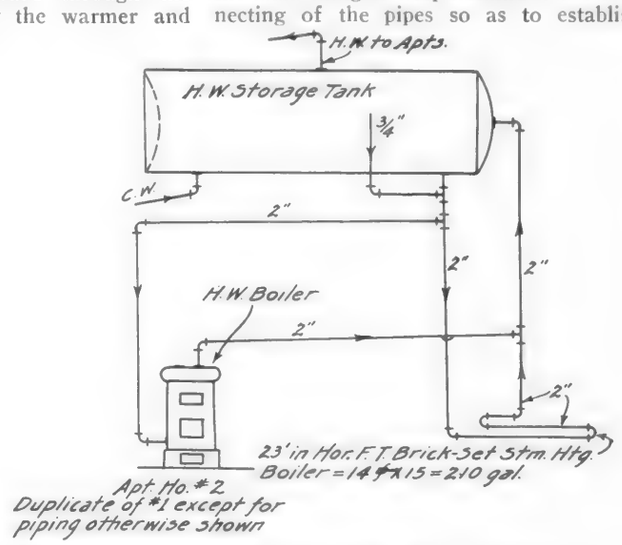



**Fig. 2—Piping Arrangement with Coils in Heating Boiler.**

high, thus maintaining the pressure on the house system when the street pressure is low. Incidentally, no relief valve is shown on the heater, but there should be one. There should also be covering on the tank, heater, and piping.

WHY THE SERVICE IS NO LONGER ADEQUATE

That the service was formerly adequate, as mentioned by the correspondent, does not imply that it should remain so in these days with each apartment fully occupied and even doubled up in the number of families per apartment, and with the tendency to take more baths than in former years. Then again, less desirable tenants will occupy the building as it ages, and a single eccentric tenant experiencing difficulties in obtaining hot water may let the water run continuously. Others not so eccentric may leave the water running while dishes are being washed or while called to the 'phone.

Especially is there a tendency to keep on drawing when the water is not hot due to underheating or inadequate circulation, as in the present case where the return circulating pipe is only three-quarters of an inch and probably clogged with rust. Once this condition prevails, most persons open wide the faucets hoping to draw off the cooler water, and as this results in drawing in additional cold water at the tank, the only immediate remedy is for the janitor to shut off water from the house until the water in the tank is fully heated, for he could never get it hot otherwise.

The janitor should watch for unjustified usage of water, particularly in the stores, where large quantities may be used in this manner. He should also regularly clean out the heater and in particular the bottom of the tank from sedimentary rust, as it stops the circulating connections between tank and heater.

MEETING THE REQUIREMENTS BY MEANS OF ANOTHER TANK

Referring to the calculations which follow later, heater and tank capacities in gallons are 214 and 870, respectively, but the hourly requirements for hot water are 780 gal., so that quick withdrawal beyond the capacity of the heater will cause a low temperature at the faucets. Consequently, another tank is needed to take care of the maximum hourly demand (if intermittent) during the time the heater is catching up, say in three hours, a better plan than an additional heater with the inefficiency of two fires. The new tank should be of size equivalent to the present tank, not larger, as overheating might result when but little water is used.

An overhead tank is best as it takes up no floor space, but if piping interferes and supports are not strong enough to carry the weight of the tank full of water, especially if hung well out from a supporting wall, then a vertical tank is required. But make certain that either tank can enter, as boiler rooms in apartment houses are usually in a depression connected to the outside entrance by narrow, right-angled corridors, and if passages must be forced through several thick stone foundation walls, it would be cheaper to use pipe coils in the firebox of the boiler.

ESTIMATING HOT WATER REQUIREMENTS

Considering the hot water requirements, the storage tank of an apartment house with one set of bathroom fixtures per apartment, but without shower baths should have a capacity of at least 20 gal. (sometimes 30 gal.) for each family where the total number of families is as many as 39, the consumption per apartment increasing where the number of apartments is less. For the given conditions, the capacity of the water heater, as determined by the formula below, is as follows:

$$\frac{2.64 \times 13{,}000 \times 0.65 \times 8}{160 - 60} = 1785 \text{ lbs.}$$

or $\frac{1785}{8.33} = 214$ gal. of water heated hourly from 60° F. to 160° F. when burning coal at an 8 lb. rate. Consequently, it will take about four hours for the heater to meet the demand, even when assuming the highest values of F. C. and the temperatures, $t_2$ and $t_1$. The formula is as follows:

$$W = \frac{G \times F \times E \times C}{t_2 - t_1}, \text{ where}$$

W = weight of water to be heated per hour in pounds.

$t_1$ and $t_2$ = initial and final water temperatures, usually 160° F. and 60° F., sometimes 180° F. and 50° F.

F = heat value of the fuel in B. T. U. per pound, usually 13,000, sometimes 12,000.

E = efficiency of heater, not over 65 per cent.

C = rate of combustion per square foot of grate per hour, variable, increasing with the size of grates to 5 lbs. for large grates, and even 8 lbs. with frequent firing and constant attendance.

—T. W. REYNOLDS.

## Poor Circulation in a Steam Heating System

EDITOR HEATING AND VENTILATING MAGAZINE:

I would appreciate your advice regarding a job installed last winter as per enclosed rough sketch. When tried out, though steam circulated to all radiators, water from the boiler backed up through the return into the rear end of the steam main, then blew through air valves on the last radiators. To remedy this condition, a check valve was placed in the return and the boiler held water but water continued to spout from the same air valves.

I believe that this condition is caused by the cold water in the return, which when heated expands so as to fill up the 2-in. pipe, as this is only 26 in. long. I drew about 15 gal. of water from the boiler, then opened the gate valve under the false water line, allowing a like amount of return water to flow into the boiler. Then the job worked fine under 2 to 3 lbs. pressure, but at pressures of 5 or 6 lbs. the check hammered and water started to leave the boiler.

The owner of the building insisted on floor radiation and would not have an overhead main, so the method used seemed the only way out. The job is correct as to boiler size and the like, all connections being run full size, and a good type of air valve is used, yet something is lacking.

J. SCANLON.

Brooklyn, N. Y.

If this query were sent to a manufacturer of boilers, probably the first thing he would do is to send out a man to clean out the boiler, and in a month he would send him out to do the same thing over

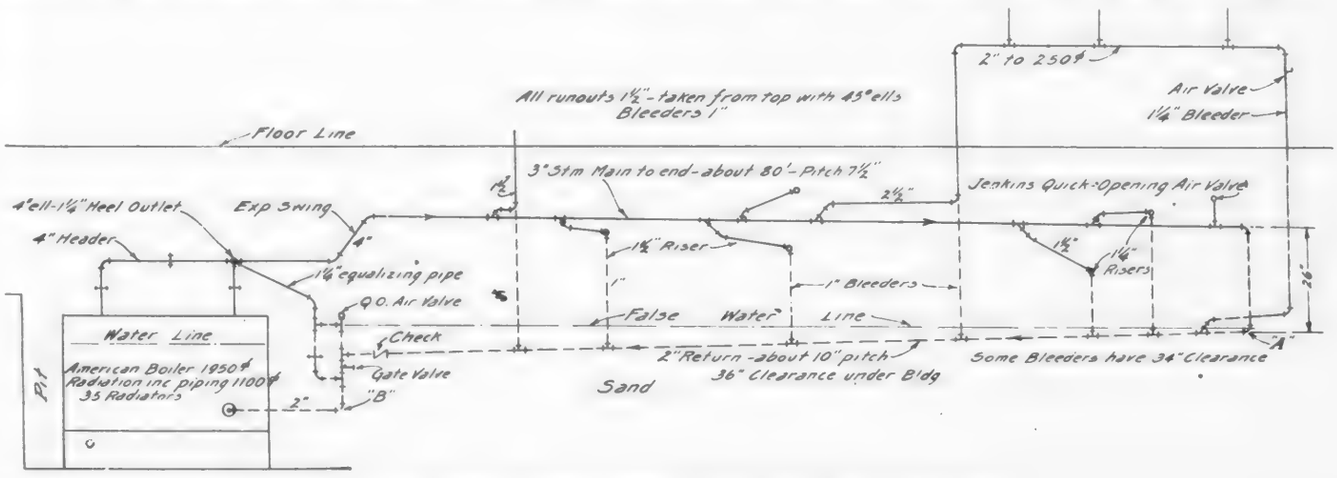



**Fig. 1—A Steam Heating System Which Gave Poor Circulation.**

again. As one practical steamfitter and troubleman of thirty years' experience said, "I have spent thousands of dollars trying out both known and unkown fancy stunts in pipe and fittings. Some worked on the first job, but not on the second. Finally, I took to diagnosing every case of trouble in steam heating systems as priming and started out to clean—well, at least each time that I passed a boiler I felt a strong urge to clean it. Whenever I cleaned out a boiler, if there was any trouble left, I would clean it out again. After this, usually there would be no further trouble."

BOILER WATER MORE OFTEN CARRIED OVER THAN BACKED OUT

Water backing up in the return—it sometimes happens, but in general it is a bugaboo. Enough water to fill the piping will not lower the boiler water-line suddenly or appreciably, as a few figures would prove, but priming will—it will raise the water in a rush, and then falling back, surge against the check valve, causing it to hammer, the surging and noise increasing with the pressure. The evidence pointing to the cause should be noticeable by the rapid fluctuations of the water-line.

With a check valve in the return there is no way for water to leave the boiler, except by priming and carrying over. If the boiler in question apparently held water at 2 lbs. pressure, it appeared so because the pressure being low, the surging was not so evident, or else sufficient time had not elapsed for much water to carry over. Priming increases the pressure drop in the steam main, causing water to back up (or be held up) and rise in the return. If there is a check valve, water will enter the boiler in pulsations with each reflux of the boiler water as it surges back, but with or without a check, water in the return will surge, though the check will steady it somewhat.

OF WHAT USE IS THE CHECK VALVE?

In any event, of what good use is the check valve if the boiler is clean? It only adds resistance and a lodgment for core sand, and while pressure closes the check, keeping the water from backing up, it also holds back the condensation as received from the radiators. The effect is the same—the water is there—whether backed up or held up.

Take 15 gal. of water from the return, as related—what does it prove? The piping is emptied of water and troubles, but for a time, then priming and condensation fill it up again and the troubles return. If it were otherwise, that is, if priming were not the cause, then the results, as stated in the question, show the system capable of being operated satisfactorily as a dry return at 3 lbs. pressure, but we all know differently—dry returns do not work properly when connected with unsealed drips from risers.

As for the theory of expansion which was advanced, this can take place only in the boiler (because of the check), making a very slight increase in the boiler water-line. How, then, can cold water, while in the return, become hot and expand? Such water enters the boiler as driven ahead by the advancing hot water of condensation, but suppose it could be heated in some unknown manner it would not expand enough to fill the radiators. A little figuring will prove this statement.

HOW THE BOILER CAN BE CLEANED OUT

Having in this way freed the piping design of all blame as a trouble maker, look to the boiler water for the cause. Apparently the boiler needs cleaning out, doubtless also the piping, but how should this be done? There are various ways—it can be done at point A and B (Fig. 1). Or, by turning on the cold water and closing the valves at the by-pass, the dirty water can be driven out through the opened top of the check valve. Then, again, some boilers have a union in the pipe connecting top of boiler and water column. In such a case, disconnect the union and swing around the pipe so as to discharge well past the front of the boiler. Then the entering cold water from the city main, being heavier, will not mix with the hot water in the boiler, but will lift it up and force it out at the union connection.

In "Steam Circulation," published by the Donnelly Systems Company, some good advice is given on boiler clean-outs. In substance, it is stated therein that such openings should be 2 in., minimum 1 1/4 in., each closed with a nipple and cap. These are placed at the base of the boiler in the front and rear sections directly opposite the connecting nipples and at the termination of the return where it drops below the bottom of the boiler at any point. A glass water-gauge placed on the return just above the water-line of the boiler is also recommended, as an unusual rise of water in the return will indicate that the boiler needs cleaning. Finally, a 1-in. surface blow should be run to one side of the boiler and provided with a gate valve, hose and iron connection, and sufficient hose to reach the nearest drain. This connection can be made from a tee located below the safety valve, or from an opening on top of the boiler.

As far as the piping design is concerned, it appears to be correct. The distance from the false water-line to the steam main seems to be greater than the advisable minimum of 18 in. to 24 in. as required to take care of the inequality of pressure in the heating system. The air valve on the steam main is desirable, though the one at the boiler serves no particular purpose. It would also have been better if the runouts to the risers had been inclined down from the main toward the drip connections at the base of risers, so as to relieve the main of condensation when the boiler is priming.

## Maintaining a Vacuum in a Gas-Steam Radiator

EDITOR HEATING AND VENTILATING MAGAZINE:

I have equipped my home with several gas-steam radiators which operate at about 5 lbs. steam pressure. In mild weather I attempted to control the heat by reducing the pressure, but discovered that if the gas flame were lowered very much, steam generation would stop, and the radiator would become filled with air.

Regarding this as faulty, I took up the matter with the gas company and with the manufacturer of the radiator in an effort to find a remedy. Their opinions were that it was of no consequence, inasmuch as the heat value of the gas was available, regardless of whether the radiator contained air or steam.

Still in doubt, I obtained some vacuum valves and put them on the radiators in the living room. I find they maintained and desired vacuum.

Will you kindly favor me with your opinion as to how much is gained by this arrangement, in view of the fact that in this type of radiator, there is no pipe resistance or pressure drop?

Chicago, Ill. L. G. B.

A radiator should give off heat through circulation of steam to all of its parts as fast as steam condenses within those parts, and the volume of heat should be distributed over a large area at low intensity, so as to avoid overheating of the air and the making of uncomfortable conditions within the immediate vicinity of the radiator. If this were not so, the installation of gas-steam radiators would be superfluous, as an open gas flame will give off its heat of combustion to the room in which it is burned.

None of these conditions is fulfilled in an air-bound radiator. Air within the radiator circulates but little, therefore heats up slowly—mainly by conduction, and, just as two bodies cannot occupy the same space at the same time, so steam is absent where air is present. These are things which reduce the effective radiating surface and motive head of the warm air column surrounding the radiator, which in turn lessens the convection currents and distribution of heat to the room.

Two of the chief offenders in steam heating systems are air and water. Their quick and effective removal is much to be desired, but, of the two, air is the greatest offender, for it retards the removal of water. A good vacuum air valve discharges the air and prevents its return.

Comparing the correspondent's two methods of operating his gas-steam radiators—with and without vacuum air valves—a laboratory test would show one of these methods to be slightly more economical than the other, providing one method gives less of heat from unburned gases than the other. But, the main thing to be considered is the practical effect, such as failure of an air-bound radiator to quickly respond and heat up when pressure is raised again, a condition which takes place in a radiator fitted with an ordinary manually-operated key valve, as such a valve possesses no automatic features.

Considering also, the absence of pipe joints in a gas-steam heating system (present in a steam heating system), there is possible the maintenance of a vacuum of, say, 25 in. in a gas-steam radiator. Steam temperatures and opera-

tion can then be changed to meet the variable conditions of climate, using steam temperatures ranging from 133° at 25 in. of vacuum to 227° at 5 lbs. pressure, and this is economical operation.

### S. Josephine Baker, M.D., Retires

S. Josephine Baker, M. D., whose report on the ventilation of certain public school buildings in New York City, in connection with respiratory diseases of children, created such a stir in heating and ventilating circles when it appeared a few years ago, has retired from the position as director of the Bureau of Child Hygiene, Department of Health of New York City. Her retirement is due to ill health.

### New York Merchants' Association Favors Arbitration in Commercial Disputes.

Responses to the commercial arbitration ballot sent out by the Merchants' Association of New York to its members recently showed an overwhelming sentiment in favor of the settlement of commercial disagreements by arbitration. Of 810 replies received up to June 22, 806 declared in favor of arbitration and pledged themselves to provide for it in their contracts.

The arbitration pledge signed by those who have replied to the questionnaire reads as follows:

"Whenever adequate machinery for arbitration of business differences is available under proper conditions, we agree to adopt the practice of submitting our commercial controversies to arbitration rather than to litigation and to that end we shall endeavor to secure an appropriate arbitration clause in our commercial contracts and agreements."

National Association of Sheet Metal Contractors of the United States at its recent convention in St. Louis, elected the following officers: President, John A. Pierpont, Washington, D. C.; first vice-president, Henry Stark, St. Louis, Mo.; second vice-president, George P. Werner, Galveston, Texas; third vice-president, D. M. Haines, Chicago, Ill., fourth vice-president, Joseph C. Gardner, Indianapolis, Ind.; secretary, Edwin L. Seabrook, 608 Chestnut St., Philadelphia, Pa.; treasurer, Julius Gerock, St. Louis, Mo. It was voted to hold the 1924 convention in Washington, D. C.

## National District Heating Association

### How Central Station Heating Engineers Look in Bathing Costumes

Some idea of the pleasures enjoyed by the delegates to the recent annual convention of the National District Heating Association may be had from the accompanying views taken, between sessions, on the beach at Cedar Point, Lake Erie. Out of respect to some of the bathers the editor is obliged to omit a full list of those shown in the photographs. Perhaps it will suffice to note the sturdy figure of Former President J. C. Hobbs in the lower left-hand corner, directing the ladies' boat race, and to say that the gentleman grimly holding the turning stake is none other than "Hal" C. Kimbrough, secretary of the American District Steam Company.

To gratify the curiosity of those who may wonder what the bathers in the upper left-hand corner are doing, we hasten to explain that they are about to engage in a drinking contest from bottles equipped with regulation nipples. The prospective winner, D. E. Karn, may be seen second from right all ready to enjoy the fruits of his victory.

**Scenes on the Beach at Cedar Point, Ohio, During the Recent Convention of the National District Heating Association.**

# Trade Association Activities That Help

Declaring that the trade association as a facility for the promotion and self-regulation of industry and commerce has become, by reason of its scope and activity, an important American business institution, with which the public, generally speaking, is little acquainted, Herbert Hoover, Secretary of Commerce, in the introduction to that department's new book entitled "Trade Association Activities" expressed the opinion that the constructive purposes of these organizations have unfortunately been confused with the minority of activities which have been used as a cloak for action against public interest.

"All trade association activities are not good, just as all individual habits are not good until so proved by their reactions on the individual and the community," the Secretary says, adding that "perhaps the best way to guide activities into the most constructive and profitable channels is through thoroughgoing analysis and examination of those activities which seem on the surface to be constructive in their application and results."

ASSOCIATIONS SHOULD TENDER STATISTICAL SERVICE.

On the subject of statistics, Secretary Hoover says, in part: "There is no question but that the curves in the business cycle from activity to depression have been less disastrous in those industries or trades where accurate, lawful statistical data have been available to all. Fundamentally it is impossible for business men to form those vital judgments as to their future course of action in the wise and safe direction of their activities unless they are informed as to the changing currents of production and consumption, not only in their own lines but also in other lines of business, which indicate broader currents of economic life. The only criteria are statistics and if industry is to march with reasonable profits instead of undergoing fits of famine and feast, if employment is to be held constant and not subjected to vast waves of hardship, there must be adequate statistical service. Whether these services are to be maintained by the Government or by trade associations, they must be maintained if we are to have an orderly economic life."

LEGISLATIVE ACTIVITIES

Discussing legislative activities, Mr. Hoover asserts that "The interest of any one industry or trade, to be sound in the ultimate analysis, must be the public interest" and in their legislative activities many trade associations have borne this axiom foremost. The demand of legislatures for the views of the different trades upon all sorts of questions of public interest is incessant, and the open preparation and presentation of such matters is far more consonant with proper development of public life than the private lobbying of the few or powerful.

Waste elimination, in a vast area of problems, can only be accomplished by collective action in a trade. Hundreds of millions of dollars have been saved through the adoption of principles laid down in such programs, not alone to the business group concerned but to the ultimate consumer. They have brought about lower prices, through attacking directly the costs of raw material, inefficient plant operation, and unnecessary stock maintenance.

With reference to cost accounting activities, Secretary Hoover pointed to the "truly remarkable findings of Government agencies in the war years regarding the knowledge and understanding of costs in production and distribution. Losses often were confused with profits, those investigations showed, all for the lack of knowledge of the fundamentals of cost accounting. To-day, the trade association is proving itself the most potent organized influence in the study of costs in industry and trade, aiming towards standard systems applicable to peculiar conditions. All of which tend to more scientific knowledge of business and ultimately lowered costs."

TRADE ASSOCIATIONS CAN IMPROVE EMPLOYEE RELATIONS

On the subject of employee relations, the Secretary indicates, that while at earlier periods the individual business concern or manager, perhaps, has taken more frequently the initiative in forward policies of such relations, trade association after trade association is now developing the necessary preliminary stages of more equitable and advanced phases of this subject. In most cases it is largely a matter of research into the tremendous problems involved—selection of personnel, education, welfare work, accident prevention, employment principles, and collective agreements. In the opinion of Mr. Hoover, the associations will recognize that in the years of devotion to improving the processes of production and distribution there has been great oversight of the human factor and its mass relation. "Shall it be approached blindly and without preparation and knowledge?" the Secretary asks, answering "Not if the present-day indications of trade association activity have real meaning."

Credit and collection activities, trade disputes and ethics, insurance, public relations, traffic and transportation, commercial research, industrial research and government relations are among the other subjects discussed by Secretary Hoover in the introduction to the book, a volume of 368 pages, sold by the Superintendent of Documents, Government Printing Office, Washington, D. C., and by the field offices of the Department of Commerce at fifty cents a copy.

# American Society of Heating and Ventilating Engineers

### New Officers for Massachusetts Chapter

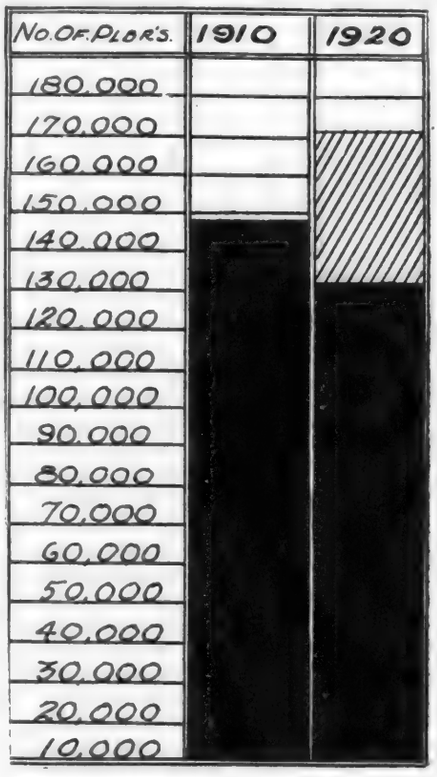
New officers of the Massachusetts Chapter, elected at its May meeting, are: President, William T. Jones; vice-president, John S. Webb; Secretary, Edmond A. Dusossoit; treasurer, William T. Smallman. Board of governors: Alfred S. Kellogg, Arthur A. Klonower and Raymond E. Shaw. The speakers of the evening were John S. Webb, A. S. Kellogg and J. P. Dwyer, who discussed various sections of the proposed heating and ventilating code being compiled by the American Society of Heating and Ventilating Engineers.

### Minnesota Chapter Elects New Officers

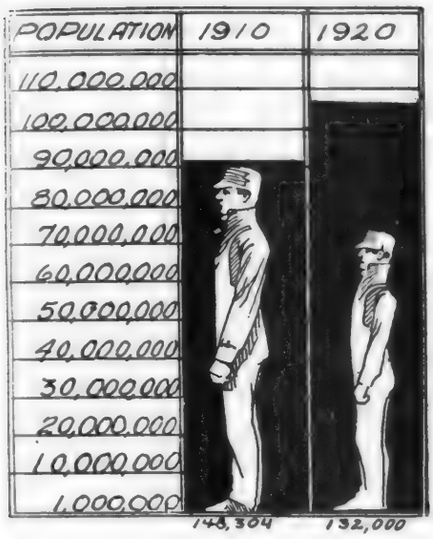
Officers elected at the May meeting of the Minnesota Chapter are: President, H. J. Sperzel; vice-president, R. W. Otto; secretary and treasurer, A. L. Sanford. Board of governors: F. B. Rowley and S. A. Challman. Mr. Otto presented a paper at this meeting discussing the hot water section of the proposed A. S. H. & V. code on heating and ventilation.

### The Thinning Ranks of Journeymen.

If every heating and plumbing shop would employ just one apprentice, declares a writer in the *T. E. B. Monthly Service Bulletin* for July, discussing the crisis that has been reached in connection with the thinning ranks of journeymen steam fitters and plumbers, the big problem before us today would be at




**Comparison of Number of Plumbers in 1910 and in 1920.**




**How Numbers of Journeymen Plumbers Has Lagged Behind Growth in Population.**

least half-way solved. It is true, as he states, that the cause for this shortage is frequently laid at the door of the unions but, he asks, if union restrictions are really to blame, it is our duty to point out to the journeymen the folly of such restrictions.

As the writer well says, every day in every way there is a growing need and demand for more and better heating and plumbing. The last ten years has seen a more general understanding of the importance of heating, ventilation and sanitation.

U. S. Census figures show an increase in population from 1910 to 1920 of 13,760,842. In the charts herewith the figure of the plumber indicates the proportion of plumbers to population in the years mentioned. There was an actual *decrease* of 16,304 plumbers in the ten years, when there should have been an *increase* of 22,152, to be in keeping with the increase in population.

The shaded area under 1920 in Chart No. 2 indicates the proportionate extent of this lack of plumbers. Instead of increasing in accordance with the population and favorable conditions, the means of installation has grown *smaller!* At the very time when the demand for plumbing and material is coming into its own, we are drifting along, unmindful of the future.

The data as to the decrease of plumbers could no doubt be duplicated in the heating trade.

# Types of Fuel-Oil Burners for Household Use

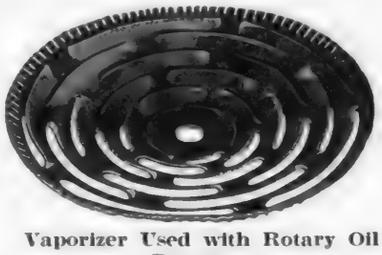
*Previous articles in this series are: 1—Combustion Fuel-Oil Burners, Sept., 1922; 2—Kleen-Heet Oil-Burning System, Oct., 1922; 3—Ray Rotary Fuel-Oil Burners, Nov. 1922; 4—Victor Automatic Oil Burner, Dec., 1922.*

VI—The Rotary Oil Burner.

Another oil-burner which hails from the West and which is differentiated from other types by being "the burner with the revolving grate" is manufactured and sold by the Rotary Oil Burner Co., 159 Twefth Street, Oakland, Cal. Its basic principle is a revolving grate on which the light portions of the oil are gasified and its carbons burned.

It is an undisputed fact, as the manufacturers point out, that the only way to obtain the maximum efficiency from the combustion of oils is by the proper admixture of oil-gas and air, and as the oil can be vaporized only by means of heat, the argument is advanced that the best way to do this is to use some of the radiant heat of the furnace to produce the gas and then simply use enough power to supply the air and mix the two gases together before combustion takes place. In other words, convert the oil into gas, supply the proper amount of oxygen, mix the two gases together at the right temperature and the result is a flame of maximum efficiency. This sequence is followed in the operation of the Rotary oil burner.

The company has some interesting comments to make on the three or four types of oil-burning systems most used today, that of atomizing by steam, air or mechanical means; by natural draft; and retort burners. The closed retort burner is mentioned as perhaps the one most used for small work. The operation of this burner is familiar, owing to the fact that the gasoline stove and blow torch are constructed on this principle. For that purpose, it is admitted, they give excellent results but when a heavy cheap oil is used for larger work a difficulty, it is maintained, is likely to arise due to the fact that the heavier the oil the greater will be its percentage of carbon, and when these oils are vaporized in a closed retort, while the light gases will be distilled off and burned, the carbon may remain deposited on the inside surface of the retort which would soon clog

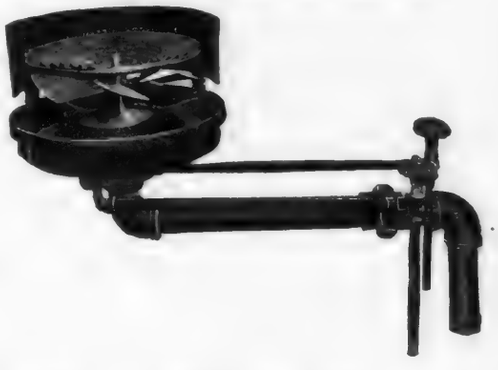


**Vaporizer Used with Rotary Oil Burner.**

the burner and render it useless until removed and cleaned. For that reason, it is argued, while this burner produces a gas and obtains a fair mixture of gas and air on light oils, its usefulness must be limited to small work owing to its inability to burn the carbon in the heavy oils.

In using the natural draft burner, in which the oil is vaporized in an open pan and the natural draft of a tall chimney is depended upon to draw the air for combustion over the vaporizing oil with sufficient velocity to create a mixture of the air and vapor, the point is made that while this burner has the advantage of vaporizing in the presence of oxygen, the heavy oils will lie on the bottom of the pan. As a result, while the heat will slowly distill off the light vapors, which are burned, the carbon is submerged in the oil out of reach of the oxygen. There is also the factor of weather conditions to be considered. Owing to the strong draft necessary for the operation of these burners, it is necessary to draw into the furnace large volumes of excess air and, of course, this can only be obtained by high flue temperatures.

No matter which one of these methods is used, continues the argument, the condition of the oil at the point of combustion is to a great extent the same, that



**Rotary Oil Burner with Upper Ring Broken Away to Show All Parts in Position.**

of breaking up the oil into fine particles and injecting it into the furnace in such a way as to cause a mixture of air and atomized oil. In commenting on the energy required to do this, it is stated that it requires from 3% to 10% of the total steam generated in the boiler to atomize the oil with the average steam burner. In low-pressure work, where there is a lack of sufficient steam pressure, it is necessary to provide a coil connected to the city water main in which to generate steam for the burner.

Atomization by air also comes in for discussion, the statement being made that although in this system we do away with the loss caused by the low temperature of the steam and the drain on the boiler, we have to consider the greater first cost and the losses caused by friction in the compressor and other machinery.

Coming, now, to a description of the Rotary oil burner, a very clear idea of its construction and operation may be gained from the accompanying illustrations.

The oil is taken in at one side, passes through the stand pipe in the center of the bowl and is emitted to the vaporizing disc through the feed holes E.

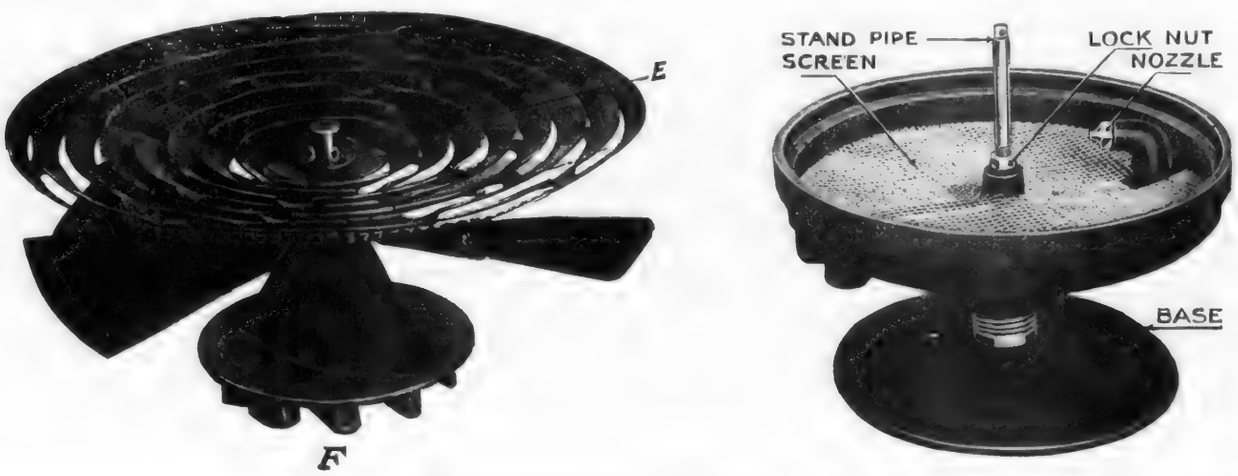
As the oil is released at the feed holes E it is immediately distributed over the entire surface of the vaporizing disc by centrifugal force, passing alternately over the raised rings of the disc and through the current of oxygen which is forced through the perforations in the disc by the fan immediately below, the lighter parts of the oil being vaporized and mixed with air closest to the center of the disc while the heavier parts are distributed over the outer portions of the disc where the velocity is the greatest and where the air is forced through the perforations in the disc more rapidly, thus vaporizing the denser portions of the oil.

The outer rings of the disc are heated to a greater temperature than the inner because the portions of the oil heaviest in carbon are consumed there.

Considering the fact that the vaporizing disc gets hotter as the radius gets greater, that the air set in motion by the fan underneath the disc is more forceful as the radius gets greater, that the velocity of the disc is greater as the radius gets greater, and that the heavier portions of the oil are carried away from the center of the disc in proportion to their weight, every condition, it is stated, has been met to have the greatest heat where the oil is the heaviest and to have the greatest oxygen and the greatest velocity at the same points, thus vaporizing the oil and mixing the oil-gas in proportion to the oil's weight.

As the oil leaves the feed holes E it passes first over a moderately-heated surface, with a moderate amount of oxygen at a slow speed, so as to vaporize and mix the lighter particles. Also as it radiates from the center it passes over an increasing heat, with an increasing amount of air and motion, in this way providing for the vaporization of all of the oil, as well as for the mixing of the oil-gas with the proportionate amount of air.

All parts of the Rotary oil burner, it is pointed out, with the exception of the two controlling valves, are within the apparatus in which they are installed. In case of a leak all leakage would pass through the drain pipe in the bottom of the burner. The burners, it is added, are made in sizes adaptable to all commercial and domestic uses, from a small cook stove to a large return tubular boiler.

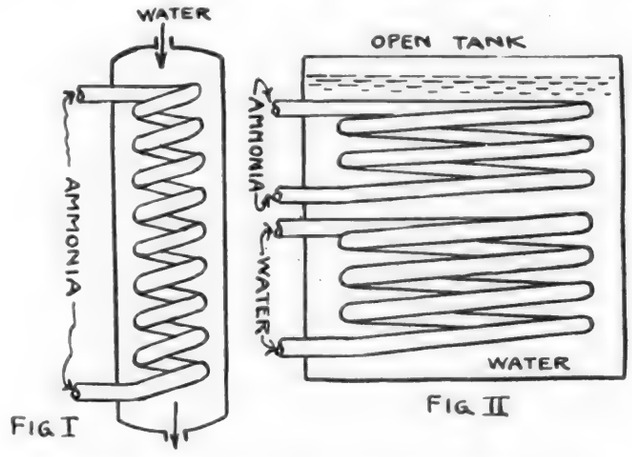



**Construction Details of the Rotary Oil Burner.**

## A Water-Cooling Scheme

In a water cooler arranged according to the design shown in the accompanying illustration, (Fig. 1) where an ammonia coil is placed inside a closed cylindrical tank for cooling the water, there is likely to be danger unless the water is kept in continuous motion and a sufficient quantity circulated. If the circulation is not maintained or temperature of the water is permitted to drop to a low point, there is danger of freezing. Of course, in that event, the tank will burst and will be difficult and costly to repair.

A better method of accomplishing the same purpose is illustrated in Fig. 2. This has the advantage of being practically fool-proof. The ammonia coils are placed in an open tank, as indicated, close to the top of the water level. It will be noted that the liquid in the open tank is not brine, but plain water. This water may freeze without doing any damage but of course, it will freeze only at the top. The tank is made large enough so that it is not likely that the water will freeze clear over to the walls, consequently, there will be no rupture. The coil, being close to the top of the water, where the water is always warmest, is in position to maintain the proper circulation. In fact, freezing of the water in the lower coils is impossible under regular working conditions.—W. F. SCHAPHORST.




**Suggestion for Fool-Proof Water-Cooling Outfit.**

## Architect and Engineer Combine Forces

A business arrangement which seems to be coming in vogue both in this country and abroad is the collaboration of an architect and an engineer to practise, not architecture, but engineering. The firm of Huntley & Wood, for instance, recently organized in London, England, as consulting engineers, is made up of C. Gordon Huntley, A.W.I.E.E., M.I.H.V.E. and William W. Wood, A.R.I.B.A. Offices have been opened at P. & O. House, Cockspur St., London, S. W. 1.

The firm will specialize in the design of the mechanical and electrical equipment of buildings, with due regard to structural, decorative and aesthetic considerations, at the same time eliminating the tendency to provide cheap schemes at the expense of the incidental builder's work, the ultimate result of which, it is stated, is more costly than an installation

accommodating itself to the architect's design.

Mr. Huntley is a member of the British Institution of Heating and Ventilating Engineers and is the author of a paper on "Ozone in Ventilation" read at a recent meeting of the institution and published in abstract in THE HEATING AND VENTILATING MAGAZINE for March, 1923.

The new firm states that it would welcome an opportunity to correspond with any readers having similar objects in view "as we feel," adds Mr. Huntley, "that only by the fullest co-operation between the two great English-speaking empires of the world can the best interests of the profession be served."

# New Apparatus and Appliances

### New Sylphon Temperature Control Instrument

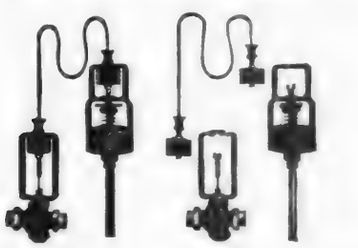
A new Sylphon temperature regulator, made up of but three parts, is the latest product of the Fulton Co., Knoxville, Tenn. It is so designed as to furnish control at a distance up to 100 ft. away from the liquid to be controlled. It is also described as equally useful for a steam line jammed up tight to the ceiling, or in some awkward corner.

**The Sylphon Bellows.**

As shown in the accompanying illustrations, the instrument is separable into three parts: the valve, the thermostatic bulb, and the power transmission tubing. Each part may be installed separately or removed separately for repair without disturbing the other parts.

The power transmission tubing is furnished in any length desired. It is filled with a non-freezing liquid and power is transmitted by liquid pressure acting between two small Sylphons. The valve is separably installed in the steam line and the bulb, in the liquid to be controlled. Then both are easily joined by slipping the power transmission unit into the T-slot connection, as shown in the illustration.

All of the Fulton Company's products, including air valves, damper regulators, temperature regulators for the control of air, as well as liquids, contain the Sylphon bellows.



Assembled Unassembled

**The New Sylphon Temperature Regulator.**

### New Ventilator Design.

A ventilator originally designed for use in connection with mine ventilation but which has been found to have general application, has been developed by Thorey I. Moen, of Beloit, Wis. Its principal features are shown in the accompanying illustrations.

In commenting upon his invention, Mr. Moen states: "It does not matter from what direction the wind blows, it will hit the wheel which, in turn operates the two fans at the right (Fig. 2). One set of fans, it will be noticed, is set to draw the foul air out and the other set blows fresh air in, so as to maintain a continuous circulation of air.

"Each side of the ventilator has an extension that opens only at the bottom, as shown in Fig. 1. This extension is closed at the roof to prevent rain or snow from getting into it, and it is covered at the bottom with screening. The two casings in which the fans run are divided by a partition marked by a dotted line (Fig. 1). On top of this partition is a cover under the gears so that the air from one side will flow into one casing, while from the other casing the air will flow out on the opposite side. In this way the incoming air and the outgoing air are always separated. By extending the two casings to any extent desired, foul air can be removed and fresh air carried to any point desired."

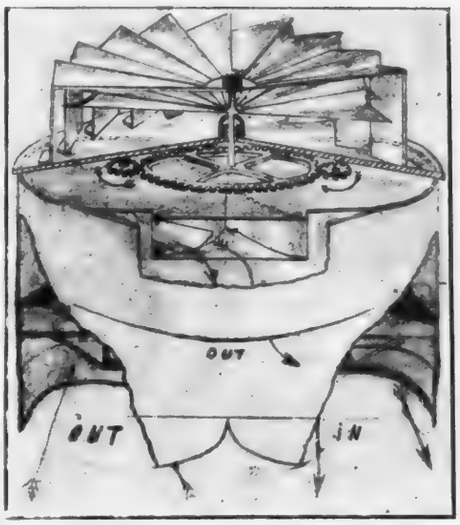



**Fig. 2—Detail of Moen Ventilator.**

This arrangement, states Mr. Moen, is particularly useful in the case of railroad coaches which can be ventilated in the manner described, whether they are moving or standing still. Also, for use in connection with gasoline engine testing rooms, or in places where there are objectionable fumes, the ventilators can be electrically-operated.

Mr. Moen has patented his device (Patent No. 1,451,884) with the expectation of disposing of it to manufacturing interests.

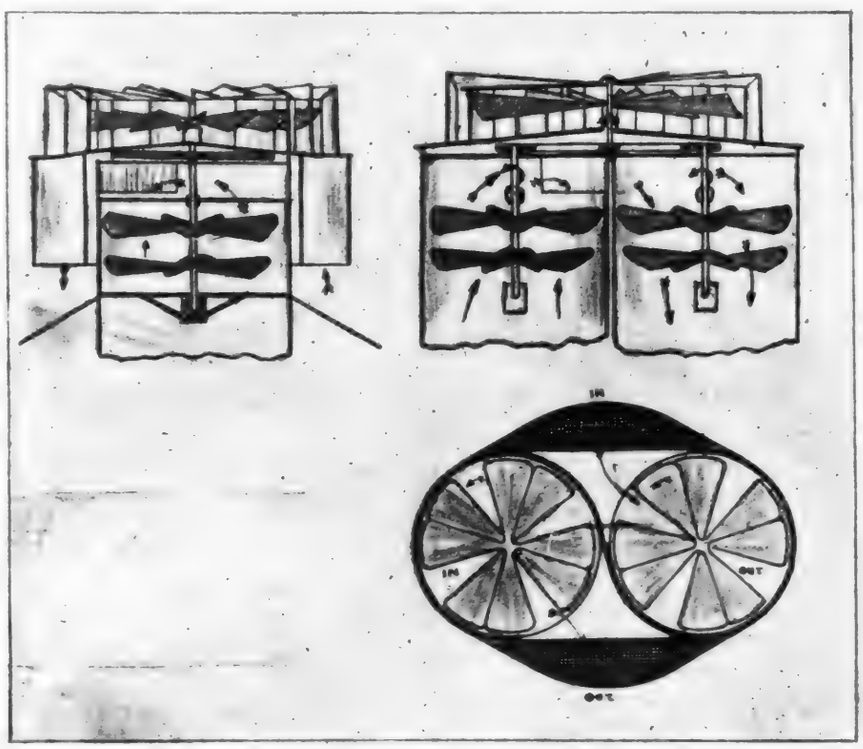
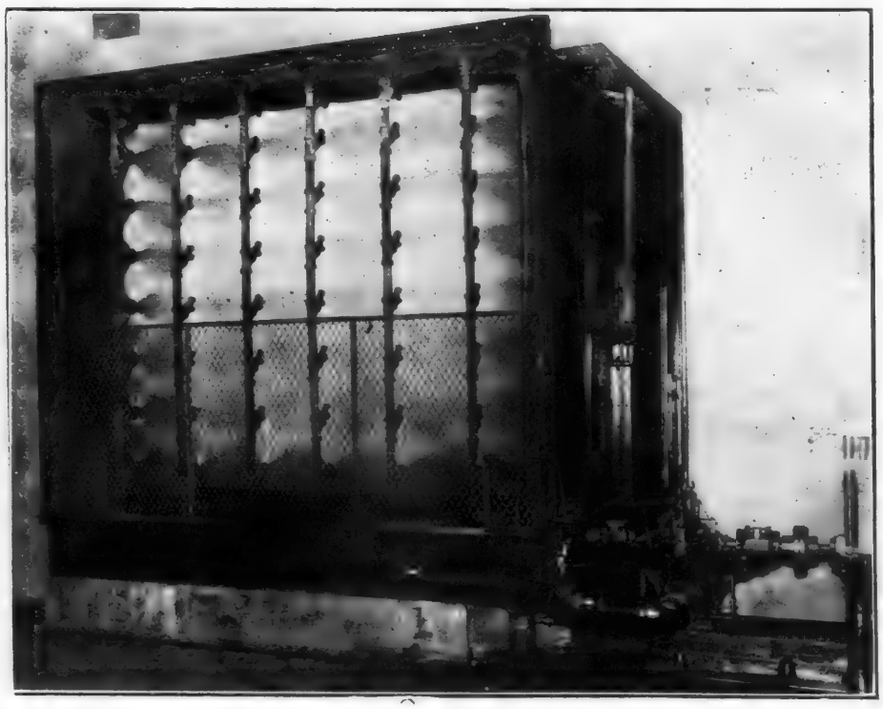


**Fig. 1—General Arrangement of Moen Ventilator.**

# New Trade Publications

SPRAY PONDS, COOLING TOWERS AND AIR WASHERS, as manufactured by the Cooling Tower Co., Inc., New York, are presented in a loose-leaf folder which shows every evidence of careful and intelligent compilation. The section on air washers is devoted to the Impact air washer, which is equipped with Impact nozzles. The washer is featured as being highly efficient in dust removal and elimination of free moisture from the washed air before it leaves the apparatus; also in freedom from interruption due to accumulation of dirt in the system and the consequent plugging of nozzles. Another feature of the apparatus is that the circulating water may be renewed and the automatic cleaning of the water box accomplished without interrupting the washing. The Impact type of nozzle used produces a flat, fan-shaped spray and the nozzles are so arranged that their sprays intersect at right angles, to accomplish a further atomization of the water and a uniform distribution of the spray. These nozzles operate under 38 lbs. pressure and spray about 4 to 5 gal. of water per 1000 cu. ft. of air washed.

The length of the washing chamber from nozzles to eliminator plates is approximately 5 ft., which is somewhat greater than in other designs, the total length of the washer being 7 ft. The company's guarantee in connection with the elimination of free moisture by the eliminator plates is that when the washer is operating no visible free moisture will pass, or can be detected in any way on a glass plate suspended back of the eliminator plates at right angles to the air flow. The accompanying illustration of the Impact spray head shows the strainer, the design making it possible to allot one strainer to each pair of nozzles. Size 8¾ x 11 in. Pp. 24.

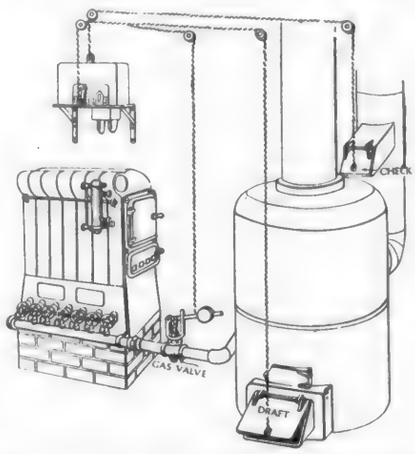


**The Impact Air Washer.**

MULTISTAGE SERIES PUMPS, a new style of centrifugal pump, has been brought out by the De Laval Steam Turbine Co., Trenton, N. J., and is described in a newly-issued catalogue. In this pump double suction impellers and volute diffusers are used, as in single-stage centrifugal pumps. The connecting passages from stage to stage, however, are included in the pump case casting, as in the ordinary multistage pump. The advantages claimed are perfect hydraulic axial balance and high efficiency under varying loads, as is characteristic of the single-stage pump. These series pumps are made with two or three stages. Where more than three stages are required, the use of two independent pumps operating in series and mounted on a single base plate is recommended in order to keep down the length of shaft between bearings.

WEATHER VEIN, Vol. 3, No. 4, the periodical of the Carrier Engineering Corporation, Newark, N. J., is devoted to the motion picture industry. Numerous views are presented of the remarkable motion-picture theater built by Sid Grauman in Los Angeles which is characterized as marking a new day in motion picture showmanship. The cover of this issue of the Weather Vein reproduces a section of the foyer in colors, although as the company's chief engineer, Logan Lewis, remarks, "It can't be described. It must be seen." An account is given of the equipment of the theatre with the Carrier downward-diffusion system by which conditioned air is introduced overhead and diffused downward, being exhausted through the floor by means of the same kind of mushrooms used in the updraft system.

THIRTY-FIVE YEARS USE OF THE MINNEAPOLIS HEAT REGULATOR in connection with central station lines, is the enviable record reported, in newly-issued circular matter, by the Minneapolis Heat Regulator Co., Minneapolis, Minn. In this class of work, states the circular, the only sure way of saving condensation is by positive




**Minneapolis Heat Regulator Controlling Tandem Installation of Coal and Gas Heater.**

open and shut control of the valve at the street intake. Shutting off individual radiators only partly reduces condensation, as condensation occurs in the radiator supply pipes. The statement is made that a central station in a middle western city supplying 300 users on a flat-rate basis has equipped each building served with a Minneapolis heat regulator. The equipment includes an eight-day duplex thermostat and a motor to operate the valve. This motor operates directly on 110-volt A. C. or D. C. from the lighting circuit. The only change, required in the heating system is the installation of a quick-opening valve which is furnished by the company. Some interesting records of savings are included, figures being given under hand control and under automatic control. The saving in steam came to one-third. Another circular issued by the company deals with the application of the Minneapolis heat regulator to a tandem installation of coal and gas heater and to a gas heater alone.

INTERNATIONAL ECONOMY BOILERS and their special features are presented in an interesting manner in a catalogue devoted to this line, issued by the International Heater Co., Utica, N. Y. Both the square and round types are equipped with carburetor principle of construction which has always been a feature of International boilers. There is, in addition a cross fire travel which is typical of the Economy type. In the square boiler the gases pass to the rear of the boiler between the coal bed and crown sheet, then up through the flue openings in the rear section into a

mixing chamber. As the gases travel toward the front they are mixed and ignited by the flames and hot gases flashing up through the ¾-in. spaces between the sections of the crown sheet. In the round type the mixing chamber is given a large part of the credit for their evaporative power. Most of the hot gases pass to the rear of the firebox, then up through the two large flue openings, through the rear of the crown sheet into the mixing chamber, or first pass. As the hot gases then travel towards the front, they are mixed and ignited, as in the case of the sectional boiler, by the flames and hot gases flashing through the crown sheet openings. Other exclusive features mentioned for the Economy boiler are the herringbone grate which is hung on a drop-frame assembled without bolts or cotter pins, the individual cleanout doors, the swinging smoke hood, and the elimination of soot pockets.

In the Economy sectional and smokeless boiler special mention is made of the provision for steam separation which, it is stated, is an exclusive feature. This steam separation takes place within the sections, thus eliminating header construction ordinarily used to separate steam from water. Grate connections are outside the ashpit to prevent them from becoming clogged or from deteriorating, side grate fingers are provided to give a uniform distribution of the draft, while large double flue doors make it possible to easily clean the boiler from the front. The smokeless type is built along the Kent wing wall principle, and embodies many of the features found in high-pressure types. The smokeless feature is placed entirely outside the firebox and is practically independent of the fireman. The boiler has a single grate which makes it easy to fire and the excess air is regulated from the front of the fire-door. Size 7 x 10 in. Pp. 32.

TYCOS-ROCHESTER for July, 1923, the monthly periodical of the Taylor Instrument Companies, Rochester, N. Y., contains, among other things, an interesting article on "Ole Roemer and the Fahrenheit Thermometer," translated from "Ciel et Terre" by C. F. Brooks, secretary-treasurer of the American Meteorological Society. Another article is entitled "Radio to Solve World's Weather Forecast Problems," which describes the plan to establish a chain of radio stations along the Arctic Circle for the broadcasting of weather forecasts. Such a station has already been established for the Norwegian government on the little island of Jan Mayen, north of Iceland, by Akbard Ekerold, which, it is stated, is being used with extraordinary success in providing accurate weather forecasts.

ECONOMY SMOKELESS BOILERS, steam and hot water types are described in a new catalogue issued by the International Heater Co., Utica, N. Y. The catalogue is illustrated with numerous views of the company's product as well as by illustrations of various types of buildings which are heated by its boilers. Attention is called to the importance of excess air control and the fact that the air needed for proper combustion is admitted over the fire through the fire door, a method recommended by the U. S. Bureau of Mines. Another important feature of Economy boilers described is the design of the steam dome so that the distance between the water line and the connecting nipples is greater than in many boilers, the extra space and the internal construction of the sections making for dry steam and a steady water-line without the use of a header. An exclusive feature of the boilers is that the return inlets and flow outlet of a steam boiler are never in the same section, this too aiding in maintaining a steady water-line and dry steam. Large doors at the front of all Economy boilers make the flues readily accessible for cleaning, while additional cleanouts are provided at the side and back for the primary and secondary combustion. The manufacturers have found after a long series of tests that they would be justified in giving the Economy smokeless boilers from 10 to 25 per cent higher rating than the corresponding hard coal boiler. It is claimed also that while soft-coal boilers are rated on an hourly basis, because of the nature of the fuel, that Economy smokeless boilers, hold several hours supply of coal. A table of ratings and dimensions is included. Size 6½ x 9½ ins. Pp. 24.

STERLCO PUMPS is the title of Bulletin No. 34 issued by the Sterling Engineering Co., Milwaukee, Wis., manufacturers of heating specialties, which introduces the new Sterlco combination vacuum condensation pump and receiver, and the air-line vacuum pump. Both products have been perfected only recently and are said to contain features not common to other rotary or centrifugal motor-driven pumps. They were designed, the bulletin states, to meet the demand for a better rotary vacuum pump. Complete descriptions, together with photographs and tables of specifications with capacities and ratings of each new product, are presented in the bulletin. Size 6 x 9 ins. Pp. 16.

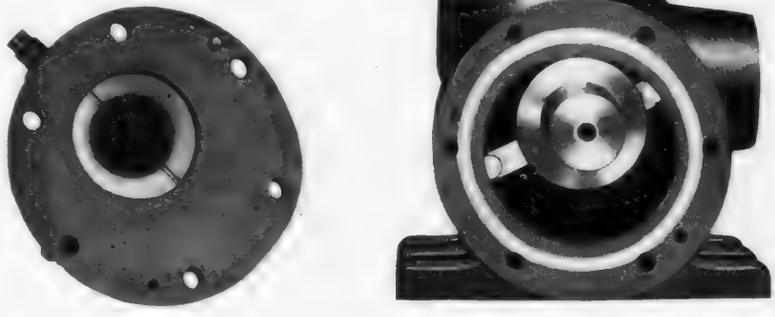
WATER SUPPLIES FOR SWIMMING POOLS is the timely subject discussed in Bulletin No. 500 issued by the Graver Corp., East Chicago, Ind. Numerous installation views are shown in the bulletin which contains also detailed data and blue prints on design, construction and operation of swimming pool water supplies. The Graver pressure filters are designed to remove all mechanical impurities, dirt or organic matter. They give the water entering the pool a beautiful blue-green tint. Heat is furnished by the Graver instantaneous hot water generator, which may utilize either exhaust or live steam. The company furnishes also apparatus for destroying germ life and microscopic organizms. One refiltering system illustrated permits of the re-use of the water several times. The water is recirculated, filtered and disinfected so that a complete change is made daily. Considerable general information as to the design and construction of swimming pools is contained in the booklet. Size 8½ x 11 ins. Pp. 16.

A-JACKS HIGH-PRESSURE STEAM DAMPER REGULATOR is described in a circular issued to the trade by the National Regulator Co., Chicago, Ill. Two charts, one showing the steam pressure of boilers under hand control and the other under A-Jacks control, paint a graphic picture of the advantages of the regulator. Another picture shows the A-Jacks ready to install in boiler or engine room. Size 8½ x 11ins. Pp. 2.

DURO WATER FILTER, a new invention developed by the Duro Pump & Mfg. Co., Dayton, O., is announced in a four page circular addressed to dealers which has just been issued. The filter is described as a physical means of filtering and purifying any water which passes through its chambers. The water passes through the inlet screen, through the Carbo-Ash then into another set of screens and the final purifier and thence into the discharge chamber. Its capacity is 360 gal. per hour.

WHICH HEATING SYSTEM AND WHY is the title of an attractive booklet published by Robert Gorden, Inc., "climate makers," Chicago, Ill. The booklet sets forth some of the main points which it is urged should be considered by an owner when he and his architect or engineers undertake to select heating, ventilating or air-conditioning apparatus. A detailed description of each of these points is presented, together with data on the Gordon mechanical fan blast heater, Gordon steam unit heater, air conditioning, refrigeration, and home heating. Heating systems for factory, mill and loft buildings of more than one story are completely described and a list of buildings where Gordon systems have been installed is included. Size 5 x 7½ ins. Pp. 36.

TRANE VAPOR HEAT forms the subject of two circulars issued by the Trane Co., La Crosse, Wis. The advantages of the Trane vapor system are cited as quick



**Construction of New Sterlco Pump.**

heat, economy in using fuel, and relatively small amount of time required in firing. The circulars are attractively illustrated with photographs and pen and ink sketches. Size 3½ x 6¼ ins.

WESTINGHOUSE ELECTRIC INDUSTRIAL HEATING APPARATUS installed in more than 300 industries are impressively listed in Special Publication No. 1667, issued by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. While the list is not complete it serves to give the trade an idea of how extensive the use of electricity for heating purposes has become. A few of the industries making use of electric heat are manufacturers of abrasives, airplanes, bricks, textiles, tools, wire, bakeries, furniture factories, foundtaurants, and rubber and steel mills. Size 8½ x 11 ins. Pp. 16.

MECHANICAL HOT BLAST HEATER is the subject of catalog No. 3 issued by Robert Gordon, Inc., Chicago, Ill., descriptive of two Gordon products, the mechanical fan blast heater and the steam unit heater. The catalog characterizes the mechanical fan blast heater as the ideal heating system for foundries, factories and large machine shops. It is recommended also for heating large or small buildings, warehouses garages, temporary buildings, schools, and concrete buildings under construction, when temporary or partial heating is desired. In operation the multivane fan used in this type of heater pulls in the air along the floor level, drawing cold air off the walls and floor, and replacing it by the heated air driven out the top of the heater by the fan. The initial cost, it is pointed out, is comparatively small and the units are easily installed and readily moved. The Gordon steam unit heater was designed particularly to allow flexibility of heat control and it can be regulated to heat a given space to any pre-determined degree. Each separate bank of coils is provided with individual steam supply valves. Thus in mild weather, one or two coils may be used without in any way affecting the volume of air handled. The catalog contains numerous reports of actual tests made and a number of letters from building owners who have found the systems satisfactory. Size 6 x 9 ins. Pp. 44.

TRIUMPH ELECTRIC RADIATORS, described as the first practical economical, electrical substitute for steam and water radiation in buildings and rooms of all types and sizes, is an interesting product which is being manufactured by the Apex Mfg. Co., Oakland, Cal., and distributed by the Triumph Sales Co., Sante Fe Building, San Francisco, Cal. It is the subject of a newly-issued catalogue. Each radiator is a complete and independent heating unit. It resembles the standard cast-iron type of direct radiator. The electric heater with which it is equipped is made up of six heating units, each enclosed in a separate tube, then grouped and inserted into the bottom opening through the radiator, which connects the several sections. Automatic control is secured through a thermostat made up in multiple corresponding to the number of units in the heater. These act to automatically regulate the temperature of the radiator.

Instead of water or steam as the heating medium, the radiator contains a "filler" or circulating liquid which fills the inside of the radiator and is used to heat the body of the iron. This liquid is a special type of oil, which is described as non-explosive, a nonconductor and an insulator. It is sealed inside the radiator in a vacuum and does not require replacement. Other features mentioned for this "filler" are that it will not freeze, boil, smell or make any noises.

## Death of James P. Marsh

In the death of James P. Marsh, founder and, until 1919, president of Jas. P. Marsh & Co., Chicago, Ill., manufacturer of indicating and recording gauges, automatic air valves, radiator traps and other steam specialties, the heating industry has lost another pioneer who figured

**The Late James P. Marsh.**

prominently in the advance of the art. Mr. Marsh died June 27, at his home in Chicago, at the age of 82 years.

Although born in Lockport, N. Y., most of his life was spent in Chicago. Always of an inventive turn of mind he founded the firm of Jas. P. Marsh & Company, in 1865, to manufacture, market and distribute his inventions. The firm was incorporated in 1909, Mr. Marsh remaining as president from that time until his retirement, in 1919. He was thus in active business for more than 60 years.

Among Mr. Marsh's many inventions is the thermostatic type of open-float automatic air valve which has come into almost universal use. Probably most of the automatic air valves and vents on the market today reflect some detail of the original type designed by Mr. Marsh.

In addition to originating numerous steam specialties, such as valves, vents, traps and similar devices, Mr. Marsh kept in close touch with the application of these specialties which resulted in continuous improvements from year to year until the "Marsh line" came to be known as one of the most complete and serviceable on the market, a distinction which this line has continued to maintain.

The company also manufactured the first thermostatic return trap, as used in two-pipe vacuum return heating work, together with numerous types of gauges, the development of each device being under the supervision and direction of Mr. Marsh.

As one of his associates has expressed it, "throughout his entire life, Mr. Marsh moved always with determination to succeed. And he did so. Those who knew Mr. Marsh best were entirely familiar with his close application to all important details. In a great measure this contributed to his success."

## Deaths

LEVI RAWSON GREENE, a Civil War veteran and for many years consulting engineer for the Walworth Manufacturing Co., Boston, died recently at his home in Cambridge, Mass. He began his business career with the Corliss Steam Engine Co., Providence, R. I., before the Civil War, and after serving in the Union army, entered the service of the Walworth Company where he remained until his death. He was a member of several engineering societies, the Masons, Loyal Legion and other fraternities.

J. HENRY HOWE, president of the Howe & Bassett Co., Inc., Rochester, N. Y., heating and plumbing contractors, died suddenly June 27, at his home in Rochester. Mr. Howe was a native of Rochester and was 71 years old. In 1885 he went into partnership with William T. Bassett. The firm was incorporated in 1913 when Mr. Howe was made president. At one time Mr. Howe was active in the political life of the city. He leaves a widow, two sons and two daughters.

## Domestic Engineering, of London, to Enlarge Its Scope

*Domestic Engineering, Heat and Ventilation*, of London, the British counterpart to THE HEATING AND VENTILATING MAGAZINE, announces that, commencing with its June issue, it will extend its sphere very considerably, both by enlarging the publication and by adopting a progressive forward policy. This journal, which is published at 9, King Street, Covent Garden, London, Eng., was founded in 1895 and has a wide circulation among heating and ventilating engineers throughout Britain. During the past decade or so it has been closely associated with the (British) Institution of Heating and Ventilating Engineers of which it is the official organ.

The publication has a new business manager who was one of Lord Northcliffe's lieutenants on the *London Times* for a number of years and had charge of the publishing of the *Times Engineering Supplement*, among other publications. The editorship remains in the hands of Alcwyn A. Jones, M. I. H. V. E.

# Market Retains Favorable Aspect

## Balance Reached of Production and Consumption. No Further Advance Expected in Near Future

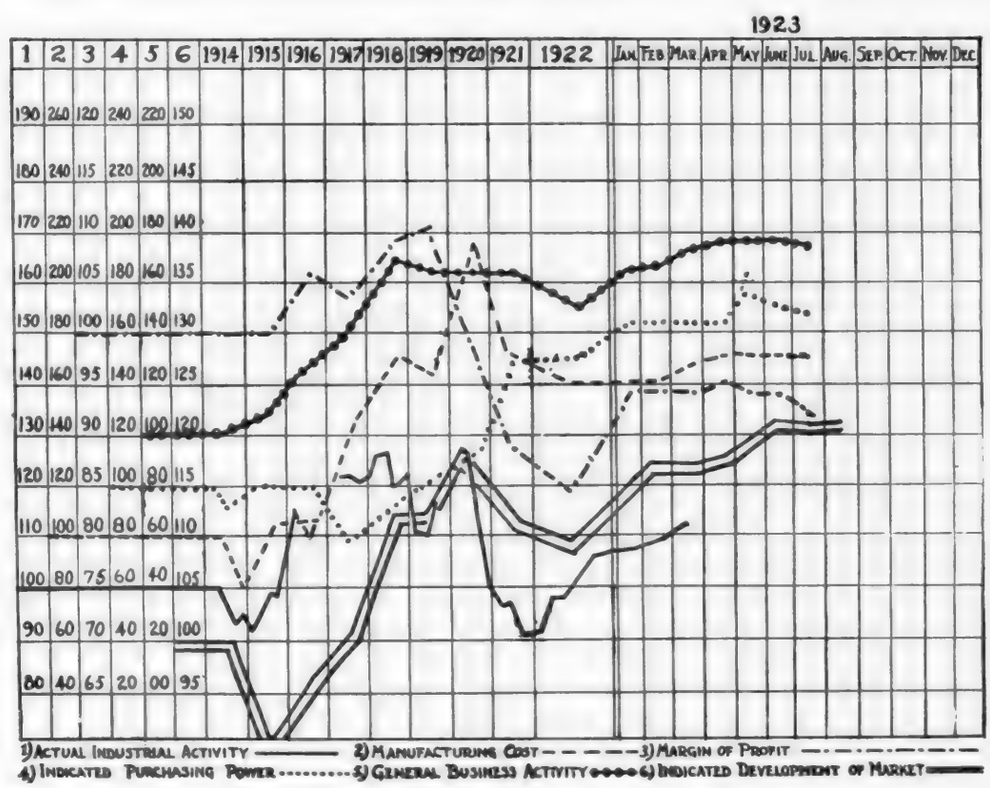
Especially prepared for THE HEATING AND VENTILATING MAGAZINE

By L. W. Alwyn-Schmidt

A steady market on a comparatively high economic level is the key note of the present situation. As the result there have been few changes only in the various factors making for national prosperity. There where a receding movement has taken place, as, for instance, in the steel industry, it has been amply recompensed by increases in other branches of the national industrial activities. This seems proof that slackness where existing is not caused by any fundamental weakness of capacity of the citizenbody. It stands to reason, therefore, that our present economic prosperity will recede again, should it prove in time that it has exceeded the rate of speed of the national capacity to produce, earn or consume, or that it will expand if these leave room for further growth.

During the year 1914 the total population of the United States amounted to 96,500,000 approximately. It is now 110,000,000 approximately, an increase of 13.9 per cent. during the period separating us from the beginning of the European war. During the same time our actual industrial activity as represented by actual employment has increased at the rate of 13 per cent. It seems, therefore, that our recent expansion has not in any way run ahead of the nation's needs in manufactured goods, but has on the contrary, kept in perfect step with the likely rate of consumption as represented by the growth of population. We are producing, in fact, no more than we might expect reasonably under the circumstances.

But while in this way a sound foundation is given for our present prosperity, there is additional reason why this prosperity should continue on the same level and why no immediate decline can be expected. The value of the purchasing power of the individual citizen is not so much determined by his actual earnings as by the relationship of these earnings to the cost of the product and by the margin left to him for further purchases after he has satisfied his most immediate needs.


1923
1 2 3 4 5 6 1914 1915 1916 1917 1918 1919 1920 1921 1922
JAN FEB MAR APR MAY JUNE JUL AUG SEP OCT NOV DEC
1) ACTUAL INDUSTRIAL ACTIVITY
2) MANUFACTURING COST
3) MARGIN OF PROFIT
4) INDICATED PURCHASING POWER
5) GENERAL BUSINESS ACTIVITY
6) INDICATED DEVELOPMENT OF MARKET

ANALYSIS OF BUSINESS CONDITIONS AT END OF JULY

the situation but is rather the outcome of the seasonal depression which is still a characteristic of many industries.

Almost a year has passed now since the swing of the pendulum changed the economic life or our nation from a severe industrial depression to comfortable and healthy activity. The time has come, therefore, to enquire into the likely continuation of the present condition. All industrial national activity derives its strength from the inherent economic health of the nation itself. The volume of production and sales can not be larger than the productive and consumptive

This margin of purchasing reserve has shown a marked increase, giving the wage earner and salaried man 139 cents today for excess purchases where he had only 100 cents before the war. It is true that the purchasing value of the dollar has deteriorated during the same period, but allowing even the conventional reduction there is still a surplus, if measured by pre-war standards. Much of this surplus margin, no doubt, has gone into savings and investments, but with prices remaining at the present level more and more of it must flow into purchases and by doing so provide the explanation for the strong

economic undercurrent which has kept up the level of the market.

Manufacturers, while taking a hopeful view apparently about the future of the market, are still willing to go slowly with plans of expansion. Also the sensible policy of keeping low the profit margin, preventing a sudden rise in commodity prices, is certain to bear fruit by a steadily increasing flow of purchases. Manufacturers are supported in this policy by the steady course of raw material prices and a similar steadiness in the wage situation which has kept manufacturing cost practically free from oscillation since the wage adjustment of last spring.

All this makes for security and health, and on the basis of the present showing there is no reason why the wave of our present prosperity, having once reached its crest, should not carry up right into the winter. If there is cause for concern it is the news of the recent decline in the price of wheat which certainly will reduce the purchasing power of the farmer and in doing so make for a reduction in sales in the farming districts. This, in turn, will rebound upon the manufacturing sections of the nation. Manufacturers will do well to watch this feature of the situation.

# How the Prosperity of the Heating and Ventilating Industry Depends upon the Nation's Economic Life

**By L. W. Alwyn-Schmidt, Consulting Economist.**

Economically speaking, the heating and ventilating industry is divided into two big groups. The first group is that devoted to the maintenance and improvement of the existing facilities for heating and ventilation. The second group embraces the design and installation of new equipment. While the character of the service flowing from these two sources differs a great deal, its quantity is influenced by one and the same factor, the varying rate of expansion of the economic life of the nation.

More specifically, the business activity of the first group is governed by (1) the natural deterioration of the existing equipment and (2) the demand for improvement caused by the general advance of the heating and ventilating art. That of the second group is determined largely by building expansion and improvements.

It is, of course, difficult to establish rules for measuring the possible size of the business derived from each of these sources. The following considerations, however, have a bearing on the matter.

The deterioration of industrial equipment proceeds at a rate varying between 5% and 15% which, at an average, would mean that heating and ventilating equipment in industrial buildings has to be replaced or permanently improved at 10% of its total value every year. The modern apartment building seems to be out-of-date at the end of 20 to 25 years, allowing a deterioration of 5% per annum, which is even exceeded in many cases. Ordinary heating equipment has a life of 15 to 25 years, with very heavy variations in boiler equipment, according to the care spent upon it. If one estimates, therefore, a total annual maintenance replacement and improvement cost of 10% of the grand total cost of all existing heating and ventilating equipment, one reaches approximately the value of the business which may be expected reasonably during each year from the first of these two leading services.

However, there has to be taken into consideration such variations of this rule as may be caused by:

1. Interruption of deterioration by great care.
2. Lack of means for making repairs during certain years.
3. Reduction of cost of equipment caused by better production methods.

These factors will bring about changes in the annual bill for maintenance and improvement work for the better or worse, as the case may be.

Most of the business done by the second group cannot grow faster than the nation itself. Each growth in the population demanding more facilities, more work for the individual and more public service also causes a correspondingly large demand for heating and ventilating equipment. If the nation grows at the rate of 1%, the equipment will also grow at the same pace, making necessary new construtcion of 1% of the size of the existing construction. The same factor which determines variation of the growth of business of the first group also applies to that of the second. But expansion in the second group may be accelerated or retarded by the general economic situation of the nation, making the economic factor even of stronger influence in this group of the industry's activities than in the first.

For several months THE HEATING AND VENTILATING MAGAZINE has published a statistical chart showing the progress and development of the national industrial markets.

It is a general complaint against statistics of this kind that they deal too much with the "has been" and not with the future. Also, it is held that there is little advantage for the business man to know what his competitors are doing, but that he wants to be informed rather about such facts as will determine the course of his own business. These objections are met by the chart in question.

It must be considered that building activity, industrial or private, is not an ultimate cause of activity in the heating and ventilating industry, but merely the result of preceding causes. These causes are:

1. The national purchasing power.
2. The prosperity of each industry brought about by economics and profit-bringing operation.
3. The general industrial and business activity of the country as a whole.

### WHAT IS MEANT BY PURCHASING POWER

Increasing purchasing power makes for larger purchasing reserve and ultimately for larger purchases. It may be well worth while to establish what must be understood by purchasing power. Purchasing power is not, strictly speaking, the whole of the money power available for purchases, but only that part which is left after the expenses have been made for the necessities of life, because only after these expenses have been met can money be spent for improvements and expansion. This is one of the reasons why the available money supply is not a safe measure of prosperity.

Purchasing power really represents the surplus of accumulated labor reserve after this labor has paid for its own sustenance. Inflation may give a larger money supply without bringing about a larger purchasing power. The purchasing power represented in the afore-mentioned chart is based upon this accumulated reserve. If this reserve is high, as is the case at present, it will be able to support the market at any time and will bring a sound foundation for the commercial transactions of the market.

But there cannot be any industrial expansion unless the industry has the means available for this purpose. These means are provided by an increase in the turnover of merchandise, including, of course, machinery, but still more by the profits made by the manufacturer himself. It is, therefore, of considerable importance to see whether the cost of production is keeping pace with the price of the manufactured article, or, in other words, whether the margin of profit left to the manufacturer is large enough to recompense him for his work and to leave sufficient money in his hand to permit him to spend part of it for improvements and expansion. But all this can not be accomplished unless business is good.

### HOW TO STUDY THE CHART.

Get first the production and sales figures of your plant. Turn them into a chart similar in arrangement to that here published. Then see for yourself whether movement of any one of the lines of the chart finds response in the current of your own business. Follow each line and see whether this response is not accidental, but regular. In the case of the chart published, this work may be largely simplified by keeping watch principally of the double line indicating the probable development of the current of business. This line should give an almost safe basis for the purpose of measuring the probable and actual business strength of the market of the heating and ventilating industry.

Of course, we cannot look into the future. But experience teaches that if we throw a piece of paper in a brook, it will follow the current of the water and that a similar piece of paper thrown in after will almost certainly repeat the performance of the first piece. The brook is the nation's market, the currents represent the various economic activities, and the piece of paper is our own business.

# Your small jobs need *Ideal Super-Packless Valves*

MANY Heating Contractors have felt that Packless Valves belong only on large installations. But there are even more reasons to install Ideal Super-Packless Valves on every small job.

The home owner is quick to appreciate the value of a valve that cannot leak. A damaged ceiling costs more than all the valves on the job.

The home owner is more particular about every detail because he is going to live with the job.

He must look to you for the latest improvements, and the quick-opening, easy-turning feature is a daily reminder of your interest in his comfort.

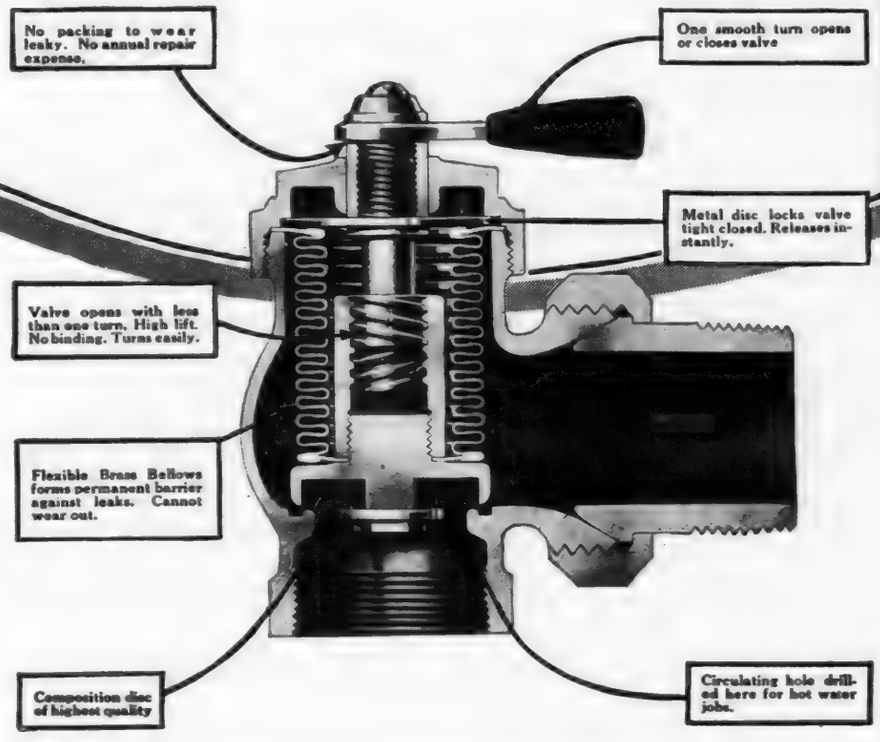
The additional profit from Ideal Super-Packless Valves will make small jobs of more value to you.

## How to sell Ideal Super-Packless Valves

1. Install them instead of repacking when old-style valves leak.
2. Show a sample side by side with an ordinary valve. Then let your customer choose.
3. Include them on every bid and when necessary add an alternative bid on ordinary valves. This will either give you a preference for your work, or a chance to talk your bid

## IDEAL SUPER-PACKLESS VALVES

*Opened or closed with one easy turn*


No packing to wear leaky. No annual repair expense.
One smooth turn opens or closes valve
Metal disc locks valve tight closed. Releases instantly.
Valve opens with less than one turn. High lift. No binding. Turns easily.
Flexible Brass Bellows forms permanent barrier against leaks. Cannot wear out.
Composition disc of highest quality
Circulating hole drilled here for hot water jobs.

## AMERICAN RADIATOR COMPANY

*IDEAL Boilers and AMERICAN Radiators for every heating need*

1807 Elmwood Avenue Dept. S-31 Buffalo, N. Y.

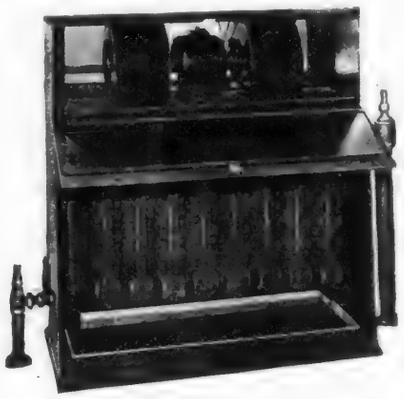
THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

## PORTABLE UNIT VENTILATORS

### Peerless Unit Ventilators

In the Peerless unit ventilator, use is made of an especially-designed Vento radiator. The complete unit, which includes fans and motor, is entirely enclosed in a cabinet of furniture steel and finished in olive green. The unit is arranged to admit fresh air from out-of-doors, the exact form of fresh-air intake depending, in each instance, upon the building construction at the point of application. The fresh air is taken in at as high a level as possible to prevent dirt, leaves, etc. from being drawn in. As an extra precaution the inlet is covered with a screen or grille.

The air is circulated by a constant-speed motor, with extended shafts on which are mounted two aluminum multiblade fans. These fans are arranged to operate at a speed not exceeding 900 R. P. M. The Vento radiator used is located in the heating chamber. There is also a water reservoir in the bottom of the cabinet which



The Peerless Unit Ventilator.

acts as a deflector to the incoming air, at the same time removing dust and dirt and humidifying the air. The heated and washed air is delivered through an opening in the face of the unit and directed towards the ceiling.

With this system exhaust ventilation is accomplished through the use of an exit grille located near the floor through which the used air may pass to a flue or directly to the outside of the building.

Recirculation of air is provided for through a recirculating intake consisting of a full-length-hinged door at the top of the unit. A grille is fastened inside the cabinet, and painted to match the exterior finish, to prevent foreign matter from entering at that point. The fresh-air inlet has louvre dampers so connected with the recirculating door at the top of the unit that the opening of one has a corresponding opposite effect upon the other.

There is also in this unit an additional air-mixing damper, operated by manual or automatic control, to provide a wide range of temperature regulation by directing the air flow through the radiator or, to the extent desired, through a by-pass. All incoming air, however, passes through the unit and over the water in the water-pan.

The radiator valves are kept open to assure ample steam supply and are provided with lock shields and key to prevent tampering. All control of the room temperature is obtained with the air-mixing damper. With the damper in the cold position and

(*Continued on Data Sheet No. 6-A*)



*Copies of this Data Sheet, printed separately, 5 cents each.*

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

## PORTABLE UNIT VENTILATORS

### Peerless Unit Ventilators

*(Continued from Data Sheet No. 6)*

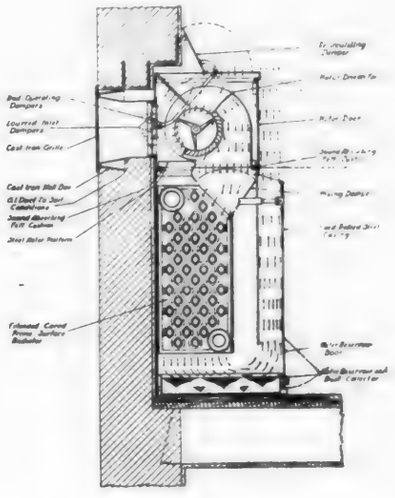
outside air at between 60° and 70° F., the Peerless unit, according to the manufacturer's guarantee, is able to pass all the air around the radiator in the unit and discharge it at a temperature rise not exceeding 5° F.

Automatic control of the air mixer is secured by means of a diaphragm motor inside the cabinet, controlling the mixing damper. A two-point compound thermostat operates the damper motor and the valves on the auxiliary direct radiation.

Sound and vibration-absorbing felt cushions are fitted to the steel platform, on which are mounted the motor and fan, to secure noiseless operation. Care has also been taken to use direct-current motors so as to eliminate all magnetic motor noises.

DIRECTIONS FOR LAYING OUT SYSTEM.

First determine the amount of air required for ventilation, figuring on 30 cu. ft. per minute per pupil in the classrooms, and from four to six changes per hour for such rooms as assembly halls and gymnasiums. The size of units having been decided



TYPICAL METHOD OF INSTALLING PEERLESS UNIT VENTILATORS, WITH AIR INTAKE THROUGH WALL

on from the above information and from Table 1, the location of the unit and the method of making the fresh-air inlet should be determined.

To determine the amount of direct radiation required, the radiation is computed in the regular way and then the amount shown in the table for the particular unit chosen should be deducted. The remainder is the amount that must be added in direct radiation. The manufacturers recommend the installation of separate direct radiation so that if the electric current should be shut off and the fan kept out of operation the room can still be heated. It is pointed out that the unit itself does not contain enough radiation to heat the average-size classroom when the fans are inoperative, having about the same usefulness as 75 sq. ft. of direct radiation.

Three methods of venting are suggested. In the first method venting is accomplished through an independent flue, usually located in the cloakroom. This is described as the most satisfactory way of venting classrooms. The second method is venting through independent flues in the classrooms. In the third method, especially where buildings have no provision for mechanical ventilation, the venting may be through the corridor and into a main vent flue located in the corridor. However, in some states this would not meet the legal requirements.

This system is manufactured by the Peerless Unit Ventilation System, 437-439 West 16th Street, New York.

*(Continued on Data Sheet No. 6-B)*



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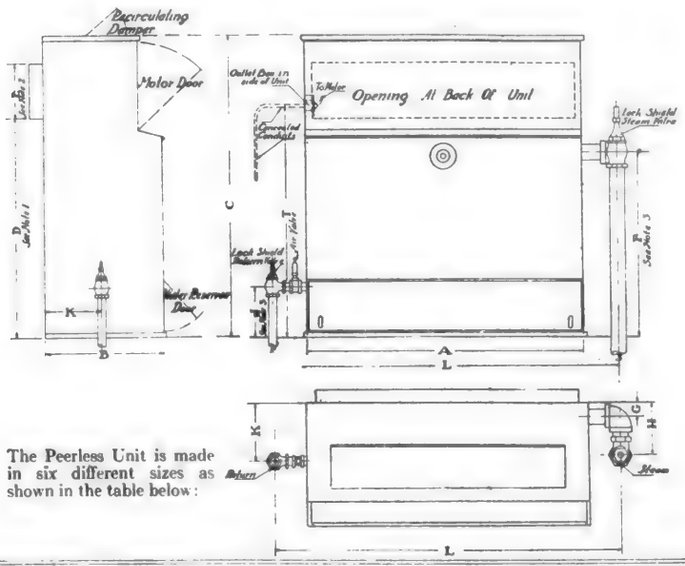
THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

# PORTABLE UNIT VENTILATORS

## Peerless Unit Ventilators

*(Continued from Data Sheet No. 6-A)*

• SIZES, CAPACITIES AND DIMENSIONS OF PEERLESS HEATING AND VENTILATING UNITS




The Peerless Unit is made in six different sizes as shown in the table below:

| Unit Number | Cu. Ft. Air per Min. Note 4 | Final Temperature Note 4 | Total B.t.u. Note 4 | General Dimensions Notes 1 and 2 | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | A | B | C | D | E |
| 720 | 900 | 72° | 77250 | 33″ | 18⅛″ | 42″ | 29½″ | 8″ |
| 724 | 900 | 83° | 97500 | 33″ | 18⅛″ | 46″ | 33½″ | 8″ |
| 920 | 1200 | 74° | 10600 | 42″ | 18⅛″ | 42″ | 29½″ | 8″ |
| 924 | 1200 | 83° | 119500 | 42″ | 18⅛″ | 46″ | 33½″ | 8″ |
| 1120 | 1500 | 72° | 128700 | 51″ | 18⅛″ | 43″ | 29½″ | 8″ |
| 1124 | 1500 | 80° | 144000 | 51″ | 18⅛″ | 47″ | 33½″ | 8″ |

| Unit Number | Steam Supply Notes 3 and 5 | | | Return Notes 3 and 5 | | L | Pipe Sizes | | T | Size F. A. Duct | Size Wall Box |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | G | H | J | K | | R | S | | | |
| 720 | 24″ | 21⅛″ | See Note 6 | 7½″ | 8¾″ | 43½″ | 1″ | 1½″ | 31″ | 10″x30″ | 10″x30″ |
| 724 | 28″ | 21⅛″ | | 7½″ | 8¾″ | 43½″ | 1″ | 1½″ | 35″ | 10″x30″ | 10″x30″ |
| 920 | 24″ | 21⅛″ | | 7½″ | 8¾″ | 52½″ | 1″ | 2″ | 31″ | 10″x40″ | 10″x40″ |
| 924 | 28″ | 21⅛″ | | 7½″ | 8¾″ | 52½″ | 1″ | 2″ | 35″ | 10″x40″ | 10″x40″ |
| 1120 | 24″ | 21⅛″ | | 7½″ | 8¾″ | 61½″ | 1″ | 2″ | 31″ | 10″x50″ | 10″x50″ |
| 1124 | 28″ | 21⅛″ | | 7½″ | 8¾″ | 61½″ | 1″ | 2″ | 35″ | 10″x50″ | 10″x50″ |

NOTE 1.—Dimension D is the minimum and can be increased to suit height of window.
NOTE 2.—Dimension E is the inlet collar on back of unit. Duct connecting to this collar should be 10 inches deep.
NOTE 3.—Dimensions F and J are to bottom of unit. Dimensions to floor will vary with window heights and floor levels.
NOTE 4.—Final temperature can be increased by cutting down cu. ft. of air per min. This will change total B.t.u.
NOTE 5.—Steam connection on right hand side of unit, return connection on left hand side. This can be reversed where building conditions render necessary.
NOTE 6.—H = 2⅛″ + distance from center of ell to center of valve used.

*(Concluded on Data Sheet No. 6-C)*



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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

# PORTABLE UNIT VENTILATORS

## Peerless Unit Ventilators

*(Concluded from Data Sheet No. 6-B)*

ENGINEERING DATA ON PEERLESS UNITS

For delivery of stated quantities of air and maintaining a room temperature of 70 deg. fahr., with steam at 5 lb. gauge pressure

—Indicates standard mechanism. Other quantities obtained by putting speed controllers on motors

| Unit Number | Entering Air at −10 Deg. Fahr. | | | | | Entering Air at 0 Deg. Fahr. | | | | | Entering Air at +10 Deg. Fahr. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cubic Feet of Air per Minute | Final Temp. Deg. Fahr. | Total B.t.u. | Direct Radiation to be Omitted | Condensation Pounds per Hour | Cubic Feet of Air per Minute | Final Temp. Deg. Fahr. | Total B.t.u. | Direct Radiation to be Omitted | Condensation Pounds per Hour | Cubic Feet of Air per Minute | Final Temp. Deg. Fahr. | Total B.t.u. | Direct Radiation to be Omitted | Condensation Pounds per Hour |
| 720 | 600 | 83 | 66960 | 37 | 69.7 | 600 | 88 | 63360 | 51 | 66.0 | 600 | 93 | 59760 | 66 | 62 3 |
| | 700 | 78 | 73920 | 26 | 76 0 | 700 | 83 | 69720 | 43 | 72.2 | 700 | 87 | 64680 | 57 | 67.4 |
| | 800 | 72 | 78720 | 7 | 82.0 | 800 | 77 | 73920 | 26 | 77.0 | 800 | 82 | 69120 | 46 | 72.0 |
| | 900 | 67 | 83160 | Add 15 | 86.6 | 900 | 72 | 77250 | 6 | 80.5 | 900 | 77 | 72360 | 30 | 75.4 |
| 724 | 600 | 94 | 74880 | 68 | 78.0 | 600 | 99 | 71280 | 83 | 74.3 | 600 | 104 | 67680 | 97 | 70 5 |
| | 700 | 88 | 82320 | 60 | 85.8 | 700 | 93 | 78120 | 77 | 81.4 | 700 | 98 | 73920 | 94 | 77.0 |
| | 800 | 83 | 89280 | 49 | 93.0 | 800 | 88 | 84480 | 68 | 88.0 | 800 | 93 | 79680 | 88 | 83.1 |
| | 900 | 78 | 95040 | 34 | 99.2 | 900 | 83 | 89600 | 55 | 93.4 | 900 | 88 | 84240 | 77 | 87.8 |
| 920 | 900 | 81 | 98280 | 47 | 102.5 | 900 | 86 | 92880 | 68 | 96.8 | 900 | 91 | 87480 | 90 | 91.2 |
| | 1000 | 77 | 104400 | 33 | 109.0 | 1000 | 82 | 98400 | 56 | 102.5 | 1000 | 87 | 92400 | 81 | 96.3 |
| | 1100 | 73 | 109560 | 15 | 114.6 | 1100 | 78 | 102960 | 42 | 107.3 | 1100 | 83 | 96360 | 68 | 100.4 |
| | 1200 | 69 | 113760 | Add 8 | 118.6 | 1200 | 74 | 106000 | 20 | 110 5 | 1200 | 79 | 99360 | 51 | 103.5 |
| 924 | 900 | 90 | 108000 | 86 | 112.7 | 900 | 95 | 102600 | 108 | 106.9 | 900 | 100 | 97200 | 129 | 101.3 |
| | 1000 | 86 | 115200 | 76 | 120.2 | 1000 | 91 | 109200 | 100 | 113.7 | 1000 | 96 | 103200 | 124 | 107.5 |
| | 1100 | 82 | 121440 | 63 | 126.8 | 1100 | 87 | 114840 | 89 | 119.6 | 1100 | 92 | 108240 | 116 | 112.8 |
| | 1200 | 78 | 126720 | 46 | 132.2 | 1200 | 83 | 119500 | 74 | 124 5 | 1200 | 88 | 112320 | 103 | 117 0 |
| 1120 | 1200 | 79 | 128160 | 51 | 134.0 | 1200 | 84 | 120960 | 80 | 126.0 | 1200 | 89 | 113760 | 109 | 117.5 |
| | 1300 | 75 | 132600 | 31 | 138 4 | 1300 | 80 | 124800 | 62 | 130.0 | 1300 | 85 | 117000 | 93 | 122.0 |
| | 1400 | 71 | 136080 | 6 | 142 0 | 1400 | 76 | 127680 | 40 | 133.0 | 1400 | 81 | 119280 | 73 | 124.3 |
| | 1500 | 67 | 138600 | Add 17 | 144 5 | 1500 | 72 | 128700 | 10 | 134.1 | 1500 | 77 | 120600 | 50 | 125.6 |
| 1124 | 1200 | 87 | 139680 | 97 | 145 8 | 1200 | 92 | 132480 | 126 | 138.0 | 1200 | 97 | 125280 | 155 | 130.5 |
| | 1300 | 83 | 145080 | 91 | 151 2 | 1300 | 88 | 137280 | 112 | 143.0 | 1300 | 93 | 129480 | 143 | 134.9 |
| | 1400 | 79 | 149520 | 60 | 156 0 | 1400 | 84 | 141120 | 94 | 146.9 | 1400 | 89 | 132720 | 127 | 138.5 |
| | 1500 | 75 | 153000 | 36 | 159 5 | 1500 | 80 | 144000 | 72 | 150 0 | 1500 | 85 | 135000 | 108 | 140.7 |



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TRADE MARK REG.

**Typical Jennings INSTALLATIONS**

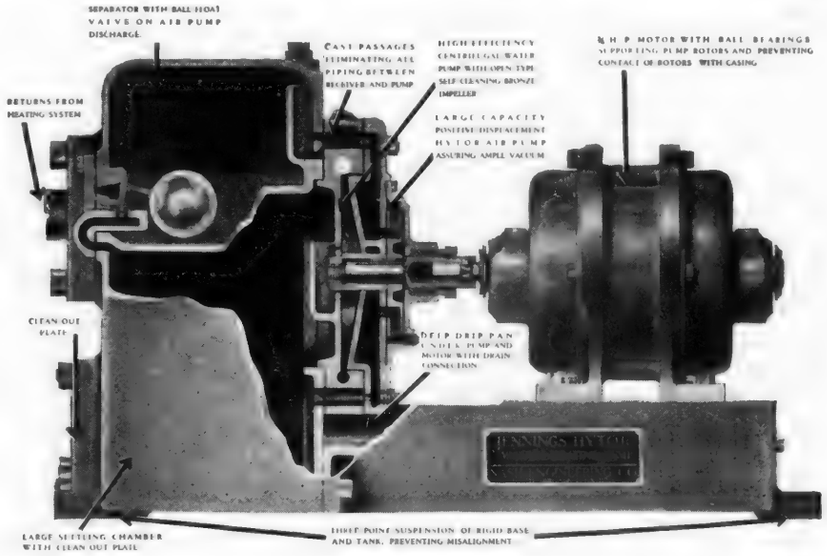
A Series

**DETROIT**

- 40 Public Schools
- Tuller Hotel—4 Units
- Book Building
- Fyfe Shoe Store Building
- J. L. Hudson Department Store
- Ernest Kern Department Store
- Packard Motor Car Company Sales and Service Building
- City of Detroit Police Headquarters
- Metropolitan M. E. Church
- Penobscot Building
- Real Estate Exchange Building
- The Hoffman Building
- The Detroit Evening News
- The First National Bank Building
- Alden Park Manor Apartment
- Whittier Apartment Hotel Building
- Newcomb-Endicott Department Store
- Detroit-Edison Company
- University of Detroit
- Hudson Motor Car Company
- Wayne County Courthouse

# The Jennings Hytor

## Return Line Vacuum Heating Pump
## Heart of the Heating System


SEPARATOR WITH BALL FLOAT VALVE ON AIR PUMP DISCHARGE
CAST PASSAGES ELIMINATING ALL PIPING BETWEEN RECEIVER AND PUMP
HIGH EFFICIENCY CENTRIFUGAL WATER PUMP WITH OPEN TYPE SELF CLEANING BRONZE IMPELLER
¾ H. P. MOTOR WITH BALL BEARINGS SUPPORTING PUMP ROTORS AND PREVENTING CONTACT OF ROTORS WITH CASING
RETURNS FROM HEATING SYSTEM
LARGE CAPACITY POSITIVE DISPLACEMENT HYTOR AIR PUMP ASSURING AMPLE VACUUM
CLEAN OUT PLATE
DRIP DRIP PAN UNDER PUMP AND MOTOR WITH DRAIN CONNECTION
LARGE SETTLING CHAMBER WITH CLEAN OUT PLATE
THREE POINT SUSPENSION OF RIGID BASE AND TANK, PREVENTING MISALIGNMENT

Size "M" Jennings Hytor Vacuum Heating Pump with integral tank. This pump has ample capacity for 5,000 square feet of equivalent direct radiation, requiring only ¾ horse power motor at 1800 R. P. M. when delivering from a vacuum of 10" of mercury against 10 pounds gauge pressure at the pump.

No matter how well designed a Return Line Heating system may be, its satisfactory operation is largely dependent upon the proper functioning of the Vacuum Return Line Pump. The Jennings pump has proven on thousands of installations that it possesses the features necessary for proper operation under the most extreme conditions.

Jennings Return Line pumps are simple in construction, containing but one moving element, running with a clearance in the casing. They are simple to install and operate, they require little floor space and are noiseless in operation. Their use results in a marked economy in coal. Many users hold that they more than pay for themselves in this respect alone. A Jennings pump on your system means quick heat in the most isolated radiators at a minimum steam pressure.

Now is the time to consider equipment for replacements and new installations for next season. Our Engineering Department is at all times ready to render service on problems relating to heating.

# NASH ENGINEERING CO.
## SO. NORWALK, CONN., U. S. A.

# Trade and Miscellaneous Notes

### Coming Events

**September 10-13, 1923.**—Eighteenth annual meeting of the American Society of Sanitary Enginers, in Davenport, Ia. Headquarters at the Hotel Blackhawk.

**October 20-28, 1923.**—Safety Health and Sanitation Exhibition at 106th Infantry Armory, Brooklyn, N. Y.

**December 12-16, 1923.**—Annual convention of the National Association of Practical Refrigerating Engineers, in Memphis, Tenn.

### Miscellaneous Notes

**Duro Pump & Manufacturing Co., Dayton, O.,** adopted a novel vacation plan this year. According to an announcement by the company, "The factory will close down from July 28 to August 6 for vacation period. Good machines, human and otherwise, always run better after an occasional rest." All factory employees were given a one week's vacation with pay according to length of service. Only a skeleton organization, for emergency purposes, was maintained at the factory during the vacation period.

Total contracts awarded in 36 eastern States, comprising about seven-eighths of the total in the country, amounted to $371,034,000. The decline from June, 1922, was 6 per cent. June figures brought the total for the first half of the year to $2,109,524,000, an increase of 9 per cent over the corresponding period last year.

**Dr. George K. Burgess** whose appointment as director of the United States Bureau of Standards was recently announced, has been chief of the bureau's division of Metallurgy since 1913. During this period his contributions to metallurgical research have been notable. Dr. Burgess was born in Newton, Mass., January 4, 1874. He received his B. S. from the Massachusetts Institute of Technology and later obtained his Second Degree at Paris. He entered the Bureau of Standards in 1903 and has been active in the work of the National Research Council.

**E. W. Smith,** treasurer of the H. B. Smith Co., Westfield, Mass., has been elected president of the Massachusetts State Chamber of Commerce. Mr. Smith is a former president of the Westfield Chamber of Commerce.

**National Exposition of Chemical Industries,** to be held at the Grand Central Palace, New York, September 17-22, 1923, is arranging a series of educational exhibits to demonstrate the returns in dollars and cents of intelligent chemical research. The exhibit is designed to convince heads of commercial organizations who are loath to spend money on research unless they can see immediate returns.

**Wenborne-Karpen Dryer Co.,** Chicago, Ill., has announced that the decision of the U. S. Circuit court of Appeals of the Second circuit, comprising Connecticut, New York and Vermont, denying the company a rehearing on the Grosvenor patent case, will not prevent recovery by the company for infringement, even in those three states, if the validity of the company's patent should be ultimately sustained for the entire United States.

**Building Activity** decreased during June, the construction volume declining 14 per cent under May, according to the F. W. Dodge, Corporation.


## —but they overlooked ventilation

Everybody on the job—all machinery in good condition—material all right and workmen apparently contented—but something the matter with the production curve.

This is the problem that our engineers have found manufacturers facing, thoughtless of the hazards of poor ventilation. The absence of good ventilation has many times been found to be the cause of decreased production.

For years the Autovent Motor Driven Fan has solved many ventilating problems, and those who are in the ventilating field have known the Autovent for its efficiency and adaptability to meet seemingly impossible conditions. And knowing this, together with their knowledge of its neatness in appearance and ease of installation, they have specified it, as thousands of installations show.

It will be a pleasure to our engineers to know of your ventilating problems.

**Autovent Fan & Blower Co.**
"Dept. H"
730-738 W. Monroe St., Chicago, Ill.

REGISTERED AUTOVENT

**Baltimore, Md.**—The usual business signs are good in the opinion of Julius H. Barnes, president of the Chamber of Commerce of the United States, who addressed a meeting of business men here recently. "There is no credit strain" he said "and with few exceptions no over-production is apparent in any line. After an unfavorable winter and late spring, nature has been kind in crop development and crops are almost uniformly promising." Mr. Barnes expressed the belief that the self-restraint and caution practised by American business men within recent months may well presage a new advance in business activity.

**Memphis, Tenn.**—A comprehensive program is being arranged for the information and entertainment of delegates to the fourteenth annual convention of the National Association of Practical Refrigerating Engineers, to be held here December 12 to 15, inclusive, 1923. A. E. Park is chairman of the publicity committee.

**National Fire Prevention Exposition** will be one of the outstanding features of Fire Prevention Week, October 8 to 13. The exposition will be held in New York City and will endeavor to visualize what is meant by the statement that there is an average fire loss of $1,000 per minute, and that at least 80 per cent of this loss is wholly unnecessary.

**Heating and Ventilating** courses are offered students in mechanical engineering at Purdue University, Lafayette, Ind. One course, particulars of which are given in the annual catalog, covers a brief study of elementary principles of heating and ventilating, with special reference to the systems used in factories, industrial buildings and groups of such buildings. The other course offers a detailed study of each type of warm air, hot water and steam systems and all of their combinations. Central station heating also is taken up in detail. Special attention is given costs and comparative efficiencies. The university laboratory provides facilities for conducting heating and ventilating experiments, including the subjects of efficiency of furnaces, boilers, refrigerating machines, radiators and valves.

**Engineering Foundation,** established in 1914 for the "furtherance of research in science and in engineering, or for the advancement in any other manner of the profession of engineering, and the good of mankind," has issued in attractive form its eighth annual report for the year ending February 8, 1923. The catalogue contains 118 pages and details the various research projects undertaken or accomplished during the year. These included an investigation of arch dams, fatigue of metals and wood-finishing processes. The Foundation reports a balance was carried forward slightly larger than a year's income.

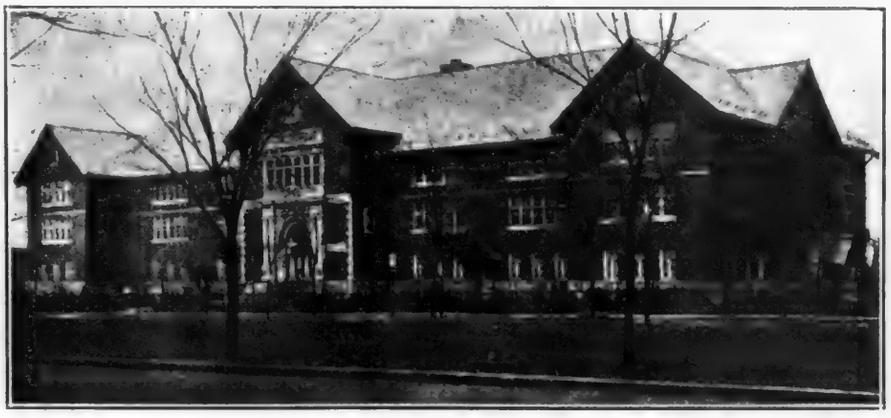
**National Board of Fire Underwriters,** comprising 191 companies, met recently in New York and elected Harry A. Smith as president to succeed John B. Morton. The retiring president stated that last year's fire waste reached the record total of $521,860,000, an increase over the loss recorded in 1906, the year of the San Francisco fire, although there was no great sweeping conflagration in 1922. The loss per person, due to fires, was $4.75 as compared with 72 cents in Great Britain, Mr. Morton pointed out.

**American Public Health Association** will hold its fifty-second annual meeting in Boston, Mass., October 8-11, 1923.

**Association of Plumbing and Heating Salesmen** is the name of a new organization recently formed in Newark, N. J. Walter F. Johnson was elected president of the association. Other officers are: Edward J. Bredehoft, vice-president; Harry J. Homer, secretary, and John F. McCue, treasurer. All salesmen calling on the heating and plumbing trades are eligible for membership. New York, New Jersey and Pennsylvania were all represented on the charter roll.

**National Pipe and Supplies Association** will be guided during the coming year by the following officers who were elected at its recent annual meeting in Cincinnati, O.: President, W. E. Clow, Jr., J. B. Clow & Sons, Chicago; first vice-president, M. W. Dennison, Braman Dow & Co., Boston; second vice-

$O_3$ A TON OF COAL A DAY WITH ELECTROZONE VENTILATION $O_3$



R. M. Milligan, Architect
Commissioner of School Bldgs.

Woodward School, St. Louis

E. S. Hallett, Engineer

The Woodward School, equal to a thirty-six unit building, was heated and ventilated during the severe weather last winter the Electrozone way, on a ton of coal per day. Bulletin V9 gives the details. It's yours for the asking.

THE AIR CONDITIONING & ENGINEERING COMPANY
2914 S. Jefferson Avenue, St. Louis, Mo.

$O_3$ $O_3$

# Bracing Weather ã la Carte

Stormy without but ALWAYS dandy weather within for attracting guests, holding tenants and to pep up salesmen, snap up workmen or speed up scholars and office workers.

Get these advantages by passing the air they breathe through a rainstorm, moisture eliminators, dirt removers, and—in cold weather—heaters coils all within a

## Carrier Air Washer

This machine removes buckets of filth and germs from the air in a surprisingly short time.
Improved attendance and production records as well as the profit sheet record the results.

Tell us your special conditions and we will promptly cooperate without obligating you.
Address dept. 36

## CARRIER AIR CONDITIONING CO. of America

**480 Broadway, Buffalo, N. Y.**

president, L. J. Merkel, the Merkel Bros. Company, Cincinnati; secretary-treasurer, George D. McIlvaine, Pittsburgh. The following were elected to fill the vacancies in the executive committee: J. A. Vann, the Young & Van Supply Company, Birmingham, Ala.; A. L. Taylor, McMann & Taylor Company, New York, and Francis J. Baker, Geo. H. Tay Company, San Francisco.

In his address the retiring president, Guilford R. Adams, emphasized the difference in conditions which had occurred during his terms of office in 1921 and 1922. This, he said, was evidenced by the cost of doing business as given last year and this year. In all of the firms reporting last year not one showed a profit in 1921. The average net loss, with interest on investment considered, was 4.77 per cent.

"One would have expected a downhearted, pessimistic gathering at that time," declared President Adams, "but men whose capital had been impaired and who had suffered great losses instead of receiving even small profits, still looked hopefully forward to the future."

## Manufacturers' Notes

**United States Radiator Corporation,** Detroit, Mich., recently gathered its branch managers from all over the country for a conference in Detroit. More than a score of managers and salesmen, as well as the general officers of the corporation, attended the meeting which was intended to promote the sales efficiency of the organization.

**Trane Co.,** La Crosse, Wis., has moved its Cleveland and Philadelphia offices to new addresses. The former is now located at 416 Euclid Building and the latter in Room 572, Philadelphia Bourse.

**Autovent Fan & Blower Co.,** Chicago, Ill., announces the appointment of the Feaster Sales Co., Inc., 1311 4th Ave., West End, Birmingham, Ala., as district representatives for the entire state of Alabama.

**Pierce, Butler & Pierce Mfg. Corp.,** New York, has purchased the business of the Savannah Supply Co., jobbers of mill, railway, heating and plumbing supplies in both Savannah, Ga., and Jacksonville, Fla. The branches will be operated as heretofore under the general directions of H. A. Butterfield.

**E. I. Du Pont De Nemours & Co., Inc.,** Wilmington, Del., announces the development by chemists of a new finish for wood and metal, which, it is claimed, will resist high degrees of heat, hot and cold liquids and hot plates or dishes. It is described also as beng waterproof.

**Lehigh Fan Co.,** Allentown, Pa., has been incorporated to take over the fan manufacturing department of Hersh Brothers Co.

**Thatcher Furnace Co.,** has announced the removal of the company's general offices from New York City, to the new Thatcher Building, St. Frances and George Streets, Newark, N. J. The New York sales offices and exhibit rooms will remain at 133-135 West 35th Street, New York. President Charles O. Lyon states the consolidation of the executive and manufacturing departments in Newark will enable the company to render more efficient service to the trade.

**Minneapolis Heat Regulator Co.,** Minneapolis, Minn., recently held a convention of salesmen at the headquarters in Minneapolis. Every phase of salesmanship was discussed, including advertising, mail orders, co-operative methods, and plans for leveling the peak of seasonable sales. This company recently announced the shipment to its New York distributor, Clarence O. Baring, Grand Central Terminal Building, of a complete carload, containing approximately 2,000 regulators. This is said to be the first time in the history of the industry that a complete carload of regulators was shipped at one time. The company has just opened a branch office in Room 400, Watkins building, 228 Third Street, Milwaukee, Wis., William F. Arnoldy has been appointed manager of the new office.

**Sterling Engineering Co.,** Milwaukee, Wis., manufacturer of the Sterling line of heating specialties, has opened an office in Cleveland, O., Room 326 Union Building, under the management of F.

PUBLIC SCHOOL No. 62, BRONX, New York City, N. Y.
*Over one Hundred Lehigh Fans are installed in New York City Schools*

# LEHIGH MULTIBLADE FANS

## FOR HEATING AND VENTILATING

WHERE large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior, to any other fans on the market.

# HERSH BROTHERS CO.

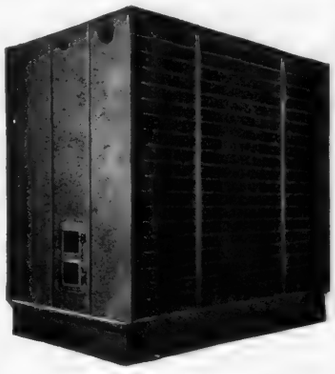
**654 Mill Street** **ALLENTOWN, PA.**

Peerless Ventilator

BUILT RIGHT RUN RIGHT

# The New York Blower Co.

**Chicago, Ill.** **La Porte, Ind.**

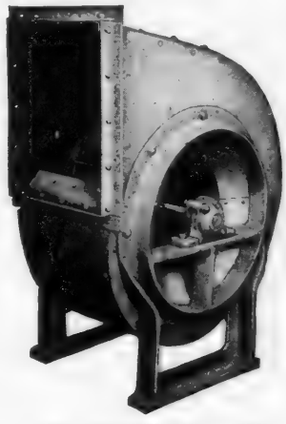


Peerless Air Washer

We manufacture a complete line of fan equipment and appurtenances. By concentrating on this one class of products we are able to make them better every year.

Pulley Driven Disc Fan for Mines

The old fallacy that fan equipment was a luxury is now known to be untrue; it is an economical necessity. We can give actual installations in all kinds of industries where through the wise employment of fan equipment manufacturers have improved the quality of their product, and increased production with a reduction in factory cost.



Type "C" Seri-Vane Fan

If you are interested in drying, humidifying, heating, ventilating, mechanical draft, removal of shavings or similar installations, please communicate with us. If we cannot honestly prove facts to you showing the benefits that will follow from ar installation for your special problem we will frankly so state.

Motor Driven Propeller Fan

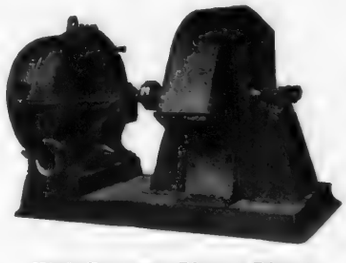
Slow Speed Planing Mill Exhauster

# The New York Blower Co.

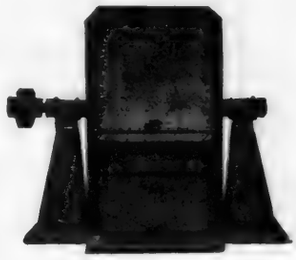
**Chicago, Ill.** **La Porte, Ind.**

*Branch Offices in Principal Cities*

High Speed Type "C" Seri-Vane Fan



High Pressure Blower Direct Connected to Turbine



Stoker Fan

V. Williams, who was transferred from the home office of the company, in Milwaukee. The company has also opened an office in Baltimore, Md., under the management of Charles Linhardt, Jr., Builders' Exchange, 15 East Fayette Street. Arrangements have been recently completed with the Provident Engineering Co., 50 Church Street, New York, to act as metropolitan representatives for this company. Mr. Goff, vice-president of the company, is spending a few weeks at the company's North Carolina office with C. C. Spoon, who was transferred to North Carolina from the Milwaukee office about a year ago.

**Fulton Co.**, Knoxville, Tenn., manufacturer of the Sylphon line of heating specialties, announces that Frank C. Reeder, who has represented the Hoffman Specialty Company in the southern States for the past four years, has resigned to take the position of factory representative with the Fulton Company. Mr. Reeder was formerly identified with this company during its early history, prior to his connection with the Hoffman Specialty Company. This appointment, it is added, is made with a view of further strengthening the sales organization of the Fulton Company.

### Central Station Heating Notes

**Astoria, Ore.**—The Astoria Central Heating Co., has been granted a franchise for the operation of a central station heating plant. The company will be incorporated under the Oregon laws with a capital of $110,000. The plant will cost $102,000. It will serve buildings within and adjacent to the area which was burned some time ago.

**Frankfort, Ind.**—The Frankfort Heating Co., is spending $15,000 in repairs and improvements to its main service lines and the North Columbia Street plant.

**Denton, Tex.**—A contract for additions to the central heating and power plant of the College of Industrial Arts has been awarded to Tennison Bros., Dallas, Tex., for $46,526.

**Bain & Robb**, Milwaukee and Minneapolis, have been awarded a contract for extensions to the central heating plant of the public schools at Blue Earth, Minn., for $25,153. This firm installed the original plant six years ago.

**Central Station Heating** courses offered through the Central Station School of Industrial Heating of the N. E. L. A. proved so successful in their third year that it is now planned to organize similar schools in the different geographic divisions of the association. The schools this year were given by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., and the General Electric Co., Schenectady, N. Y.

**A Central Steam Heating System** which has just ended its first year of operation in a mid-western city may be purchased on a profitable basis. For obvious reasons the name and location of the plant are not made public but may be had upon inquiry. The company was organized and is being operated by a group of citizens, who, having made a success of the venture, are anxious to place it in good hands and give all of their time and attention to their individual business.

### New Firms

**Fond Du Lac, Wis.**,—William Bresnahan and Archie McArthur have formed a partnership under the name of Bresnahan & McArthur, to engage in the heating and plumbing specialties business. The firm has leased the property at 26 East First Street.

### Contracts Awarded

**Newman-Johnson Plumbing Co.**, Evansville, Ind., heating courthouse and jail, for $31,619 (low pressure) or $37,599 (high pressure).

Other bidders were H. G. Newman Plumbing Company, low pressure, $32,840, and high pressure, $39,330; H. A. Grant Plumbing Company, low pressure, $33,892; the Wahnsiedler Company, low pressure $33,420, and high pressure, $39,520; S. A. Schmitt Plumbing Company low pressure, $32,964, high pressure, $39,804; Gottman and Weber Company, low pressure, $33,677, and high pressure, $39,897; John E. Woolley and Son, low pressure, $33,149, and high pressure, $39,070.

**A. G. Rose**, New Orleans, La., heating and plumbing Hotel Grunewald, for $35,780.62.

**Salem, Ore.**—Bids were received as follows for heating and ventilating the new Grant Junior High school building in Salem, Ore.: Rushlight & Hastorf, Portland, $12,633; George W. Kendall, $12,840; W. S. Fleming, $13,414; T. M. Barr, $13,500;. and William E. Bunce, $16,121.

**Shamokin, Pa.**—The contract for the preliminary work for the new ventilating system for the Mahanoy tunnel was awarded by the Philadelphia & Reading Co., to Patrick Campion, Mahanoy City, Pa. The work will cost between $80,000 and $100,000.

**Stockton, Calif.**—Bids were received as follows for heating and ventilating the new City Hall of Stockton: Stockton Plumbing & Supply Co., $28,025; J. W. Plecard, $30,899; F. P. Sexton, $33,899 and Brant Bros., $30,801; for heating, plumbing and ventilating: Miller-Hars Co., $64,596; Latourette & Ficol, $66,250; Edward L. Knekow, $62,280.

**Walter Noerenberg Co.**, Waukesha, Wis., heating and ventilating the Hadfield and White Rock schools in Waukesha, for $16,669.

**Salem, Ore.**—Contracts for heating institutions have been awarded as follows; boys' dormitory, State Institution for Feeble Minded, to L. E. Inman, $2,650; open-air pavilion, State Tuberculosis Hospital, to L. E. Inman for $900; and boys' dormitory, State School for Blind, to C. R. Yundt for $6,934.

**Jud & Ormond**, San Antonio, Tex., heating public schools Nos. 3, 21, and 32 in San Antonio, for $10,092.04.

**Colorado Springs, Colo.**—Bids were received as follows for heating and plumbing for the Colorado Springs high school gymansium: J. R. Seaton & Sons, Chardron, Neb., $29,369.85; Barnes & Marden, $34,851; Jardine & Night, $34,405; McCarty & Crandall, $33,729; and J. C. St. John, $34,693.

**Gogebic Plumbing & Heating Co.**, Ironwood, Mich., heating and plumbing the new Verona school for $12,637.

Sage Hall, Yale University, New Haven, Conn.

*Built on Twenty Years' Experience*

**Barnes & Jones System**

**of Modulation Vapor and Vacuum Heating**

**The most exacting requirements are found in heating of schools, colleges and surrounding buildings. The illustration shows one of many equipped with Barnes & Jones Heating Systems.**

*Specify and Use Barnes & Jones*

**BARNES & JONES**

**9 Melrose Street, Boston, Mass.**

MODULATION VALVE

# The Johns-Manville Underground System of insulation
## — an engineering service

AT less than one-third the cost of a walking tunnel, the Johns-Manville Underground System of Insulation offers you a highly efficient method of carrying steam lines underground, constructed according to the highest engineering standards.

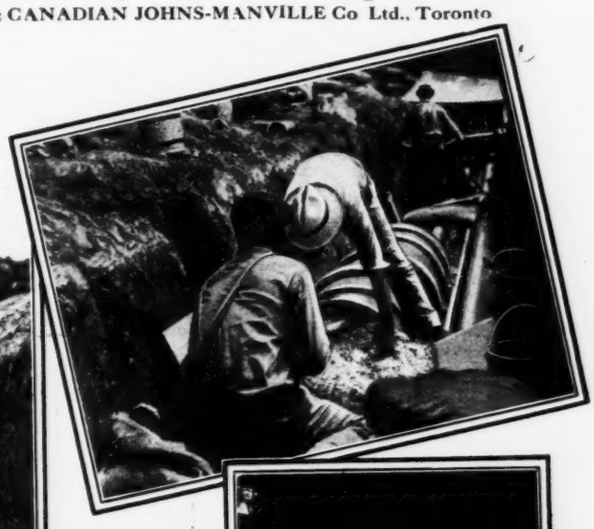
Through careful design, selected material, and installation under trained engineers, this system achieves an efficiency that makes the central heating plant by far the most economical method of heating groups of buildings.

**JOHNS-MANVILLE Inc., Madison Ave. at 41st St.**
**New York City** *Branches in 59 Large Cities*
**For Canada: CANADIAN JOHNS-MANVILLE Co Ltd., Toronto**

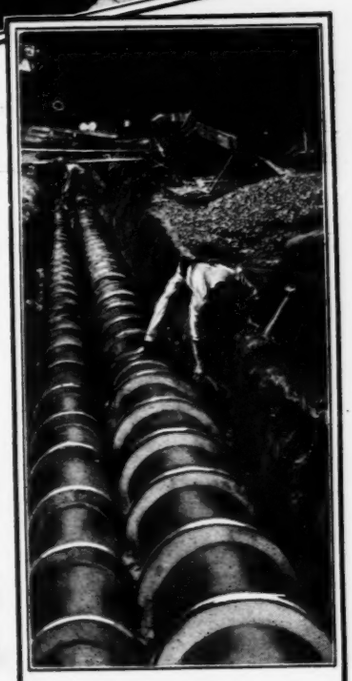
*Laying the Underdrain*

*Lining up Rollers*

*Acetylene Welding with Pipe in Place—This Type of Joint Will Outlast the Pipe itself*



*Inserting the Insulating Material Inside Conduit*



*Completed Conduit. Joints Cemented and Waterproofed*

Through **Asbestos** and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
FIRE PREVENTION PRODUCTS

# JOHNS-MANVILLE

**Charles Liniger,** Hartford City, Ind., heating and plumbing the new school building at Upland, Ind., for $24,630; and heating and ventilating the new school at Mattews, Ind., for $14,790.

**Aberdeen, Wash.**—Bids were received as follows for heating and ventilating the new J. M. Weatherwax high school building, in Aberdeen; Elway & Miller Co., Aberdeen, $12,821; A. J. Fletcher, Aberdeen, $12,987; and Norton & Spangler, Seattle, $13,205.

### Contracts Awarded

**Carstens Brothers,** Ackley, Ia., plumbing, heating and wiring the new $375,000 high school building in Keokuk, Ia.; also heating and plumbing new high school building in Waterloo, Ia.

**W. J. Corbett Hardware Co.,** Tuscon, Ariz., heating new Tuscon, Ariz., high school building for $62,000.

**Athens, O.**—H. P. Meyer Co., of Indianapolis was the low bidder, at $86,000, for heating, ventilating and plumbing for the high school building at Athens, O.

**James Smyth Plumbing & Heating Co.,** Spokane, Wash., heating and plumbing in the new Western Union Life building in Spokane, Wash. The building will cost $260,000.

**Elkhart, Ind.**—The following bids were received for heating and plumbing proposed auditorium and gymnasium in Elkhart: heating, Chapman & Phelps, Sturgis, Mich., $33,570; plumbing, William Dreves, Elkhart, $4,244. For construction of heating plant for High and Central buildings, W. L. Pierce, Huntington, was low bidder at $50,260. All of the bids were rejected as they were greatly in excess of the estimated cost.

**Ed. Gibbons Co.,** Lansing, Mich., heating, ventilating and plumbing in new Kalamazoo Street school in Lansing, Mich., for $26,578.

**Mt. Vernon, O.**—Bids were received as follows for heating and ventilating the Knox County Memorial building: C. G. Snow, Mt. Vernon, $20,629.41; Knox Plumbing Co., Mt. Vernon, $19,570; Huffman-Wolfe Co., Columbus, O., $19,781; and S. A. Esswein Heating & Plumbing Co., Columbus, O., $29,414. The latter bid included plumbing.

**Colorado Springs, Colo.**—Bids for heating and plumbing for the Colorado Springs high school gymnasium were received as follows: J. R. Seaton & Son, Chadron, Neb., $29,369.85; Barnes & Marden, $34,851; Jardine & Knight, $34,405; McCarthy & Crandall, $33,729; and J. C. St. John, $34,693.

**Himstedt & Son,** Little Rock, Ark., heating the new Garland School in Little Rock, Ark., for $15,815 and plumbing $5,363.

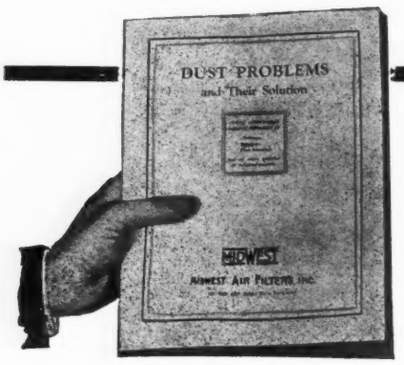
**Bellflower, Calif.**—Bids were received as follows for heating new high school building: F. Davidson, $21,935; F. J. Bonnaly, $25,384; J. Hokom, $22,509; Franklin Boice, $21,971; Western Engineering Constructions Co., $31,000; G. Hill & Son, $23,983.

**Austin, Gorham, McIllvaine Co.,** Philadelphia, Pa., heating new Junior high school at Torresdale avenue and Wakeling St., Frankford, Pa., $89,762. The ventilating contract was awarded to William Howlett Co., Philadelphia, at $3,650.

**Pasadena, Calif.**—Bids were received as follows for heating new Opportunity School: Munger & Munger, Pasadena, $15,384; Foss & Jones, Pasadena, $15,539; W. F. Creller, Pasadena, $15,750; Franklin & Boyce, Pasadena, $15,890; Thomas Haverty, Pasadena, $16,502; and Lohman Bros., Pasadena, $17,382.

### Trade Literature

TURBO BLOWERS AND TURBINES, manufactured by Carling Turbine Blower Co., Worcester, Mass., are described in Bulletin No. 20, recently issued. The bulletin is attractively illustrated with installation and shop views and by diagrams showing specifications. No. 9 A Special 2 H. P. Carling steam turbine, without governor, and No. 12 A special 5 H. P. Carling steam turbine, equipped with overspeed trip governor, are two products described and illustrated in the booklet. The latter is designed with pulley for belt drive and is used largely by building contractors as a power unit where electricity is not available or where electric motors are not practicable or where explosive elements may be found. The turbine casing is made of close-grained cast-iron of heavy construction, with cover of same material.


**Just off the Press**

Send for your copy of this new Data Book which helps you to solve dust difficulties of every kind.

**Address Dept. F-4**

**Figure the Dust Factor in Every Ventilation Problem!**

An ample supply of *fresh* air is only part of the solution. Adequate ventilation of public buildings, factories, schools, etc.; cooling air for electrical equipment; the control of dust and dirt in working air of factories, all hinge on *clean* air!

**MIDWEST** TRADE MARK **Air Filters**

Solve the dust phase of ventilating problems. There are types to meet every condition. There are no water sprays, moving parts, or any equipment requiring operating supervision. Periodic cleaning one unit cell at a time is the only labor involved.

Our engineers can be called into consultation at any time without obligation on your part, to help in the solution of ventilating problems.

**MIDWEST AIR FILTERS**

MIDWEST CANADA LIMITED
83 CRAIG ST., W.
MONTREAL CANADA

INCORPORATED
100 EAST 45TH STREET
NEW YORK CITY
BRANCHES IN ALL CITIES

MIDWEST AIR FILTERS PACIFIC, INC.
953 MONADNOCK BUILDING
SAN FRANCISCO, CAL.

# REED AIR FILTERS

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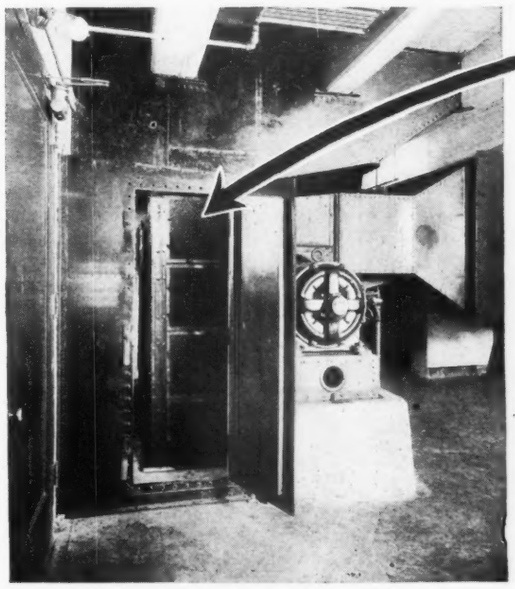
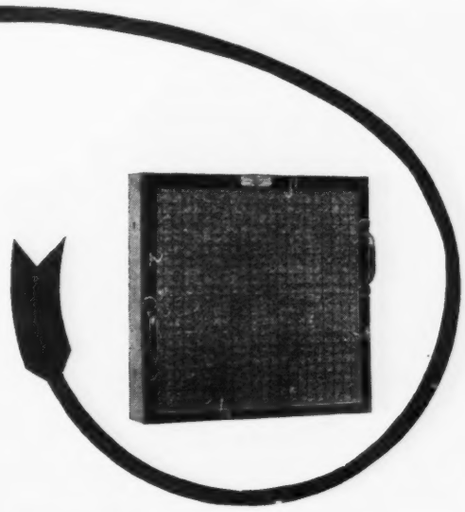
## NO WATER - NO MOVING PARTS - NO REPLACEMENTS

## HIGHEST EFFICIENCY

MECHANICAL DUPLICATION OF THE HUMAN NOSTRIL
NATURE'S PROVISION FOR THE ELIMINATION OF DUST



One of several Batteries of
Reed Air Filters
United Electric Light & Power Co.
Hell Gate Station, New York



GUARANTEED
97% Removal of all
DIRT
DUST
BACTERIA

CLEAN AIR IS AS ESSENTIAL TO THE PROPER PERFORMANCE OF MACHINERY AS IT IS TO THE HEALTH OF MAN

**WILLIAM REED ENGINEERING CO.**
INCORPORATED

**REED AIR FILTERS**

**NEW YORK** **LOUISVILLE, KY.**

BOSTON
SPRINGFIELD
PHILADELPHIA
BALTIMORE
PITTSBURGH
ROCHESTER

CLEVELAND
DETROIT
CHICAGO
MILWAUKEE
MINNEAPOLIS

CINCINNATI
KANSAS CITY
ST. LOUIS
INDIANAPOLIS
DALLAS

NEW ORLEANS
BIRMINGHAM
ATLANTA
CHARLOTTE
MEMPHIS

SAN FRANCISCO
LOS ANGELES
SEATTLE
PORTL AND
SPOKANE

The bearings are held in removable sleeves for easy replacement and adjustment and the rotor is made of bronze alloy with blades of cupro-nickel, inserted by a patent process. Nozzles are made of tobin bronze. The governor is of the centrifugal type, acting through leverage against spring adjustment to operate a balanced steam admission valve. Size 8½ x 11 ins. Pp. 20.

CONQUERING CORROSION is the title of Bulletin N-4 published by the Elliott Co., Pittsburgh, Pa. It discusses the problem

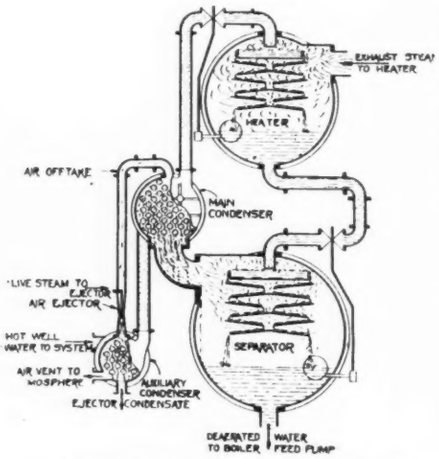



**Diagram Showing Operation of Elliott Deaerator.**

of corrosion of piping in buildings, as well as in boilers and economizers in power plants. The bulletin is illustrated with numerous installation views of Elliott deaerations now in service, and shop views of other units. The Elliott deaeration process consists, the bulletin states, of injecting heated water into a region of vacuum where violent and explosive boiling occurs. This action liberates the dissolved gases, such as oxygen, nitrogen, and carbon dioxide. Heat liberated in the process is recovered in a condenser, cooled by the incoming water on the way to the heater. Non-condensable gases are exhausted from the condenser by an air-ejector. The Elliott deaerator is said to be extremely flexible and takes the place of an ordinary feed-water heater. The apparatus may employ either closed or open type of heater, jet or surface condenser. The company states it is prepared to build Elliott deaerators for power plants in units up to a capacity of 1,000,000 lbs. per hour. For building service it builds them as small as 500 gal. per hour. Size 7½ x 10½ ins. Pp. 20.

## Current Heating and Ventilating Literature

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VACUUM. Vacuum- Vapor Heating Systems, E. R. Pierce. Domestic Eng. (Chicago), vol. 101, nos. 11 and 13, Dec. 16 and 30, 1922 and vol. 102, nos. 1 and 4, Jan. 6 and 27, 1923, pp. 475-477, 573-576, 32-34 and 171-174, 25 figs. General history of growth of various types of vacuum, vacuum-vapor and straight vapor systems. 20c each.

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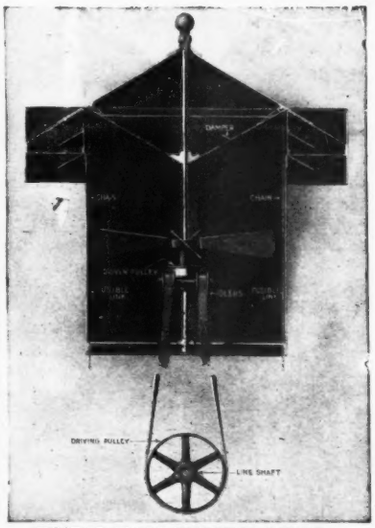

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